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Articles dealing with any phase of botany relating to the Upper Great Lakes Region may be sent to the editor in chief. In preparing manuscripts, authors are requested to follow our style and the suggestions in "Information for Authors" (Vol. 15, p. 238).

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A STUDY OF ~~BAKER~~ WOODLOT
II. DESCRIPTION OF VEGETATION

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The history and physical environment of Baker Woodlot have been presented (Beach & Stevens, 1979). The vegetation is more or less characteristic of the beech-maple forest described by Braun (1950). This type of forest is found on moist but usually well-drained alfisol soils in southern Michigan, parts of northern Indiana, Ohio, and southern Ontario. This region now consists mainly of farmland, and mature stands are scattered remnants of a once widespread forest. Most of the information we have on the beech-maple forest comes from studies such as our own on such remnants. Each tract seems to have its own peculiarities that tell us something new about the range in variation in the composition of the native vegetation. Although the primary purpose of this paper is to document the vegetational characteristics of Baker Woodlot, we have included information on three other local beech-maple woods in the hope of illuminating some of these variations.

Because of the lack of detailed records on the planting and cutting programs carried out in Baker Woodlot, it is difficult to assess the "naturalness" of the current assemblage of plants. The vegetation represents in large part growth since the turn of the century, by which time heavy cuttings had put the area in a poor condition. Certainly some species have benefited and others have become less common as a result of these and later cuttings. Both the specificity of the harvest and the disruptive influence on the forest would be factors bearing on the abundance of any particular group. While some elements of the original forest almost certainly have been lost, it is likely that the taxonomic diversity of the flora has been maintained or increased by the introduction of weedy and exotic species.

DESCRIPTION OF VEGETATION

In the summer of 1973 the arborescent vegetation was analyzed by the point-centered quarter method (Cottam & Curtis, 1956). Four east-

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west transects were run through the woods and data were recorded for a total of 588 trees one inch d.b.h. or larger at 147 sample points. The east-west paths and standing water in the western ponds were deliberately avoided in setting up the transects. In addition we did not sample in the area which contains Gysel's wildlife cutting plots which were clearcut in the early 1950's (see Beach & Stevens, 1979). (The 100-ft square plots which were clearcut are dense stands of stump sprouts today.) Points along the transect lines were chosen by the use of a random numbers table.

The results of sampling are shown in Tables 1 and 2. Also included in these tables are point-centered quarter data from Sanford Natural Area (Beaman, 1970a) from sampling in 1969 and data derived from a 1970 inventory of Toumey Forest by Gerhardt Schneider then of the Michigan State University Department of Forestry (unpublished). Sanford Natural Area is a 35-acre beech-maple woods one-half mile north of Baker on the Michigan State University Campus. Toumey Forest is a 15-acre virgin beech-maple preserve about $\frac{3}{4}$ mile southeast of Baker.

It is evident from sampling data that *Acer saccharum* is by far the most important tree in Baker Woodlot. Its density, dominance, and frequency have more than twice the value of any other species. The only areas where the importance of this species diminishes significantly are around the edges of the ponds, where it gives way to *Acer rubrum* and other lowland species. In our sampling we did encounter 12 individuals of black maple, which we consider a variety of sugar maple. Black maples are scattered throughout the area.

The importance of *Acer rubrum* in Baker is perhaps the most deviant and interesting characteristic of the arborescent vegetation. Our data indicate that this species is of greater importance than *Fagus grandifolia*. This is in sharp contrast to the importance of red maple in Sanford and Toumey. This species is abundant in wet areas and also common in drier sites. The high density of this species may in part be a response to cuttings in the past. These periodic disturbances in Baker probably have favored the growth and reproduction of the shade-intolerant species. It is interesting to note that in Sanford, silver maple (*Acer saccharinum*), like red maple in Baker, has a higher importance value than beech. Beaman (1970a) mentioned that in Sanford Natural Area silver maple replaces sugar maple around intermittent lagoons located near the Red Cedar River.

The distribution of *Fagus grandifolia* in Baker is peculiar. The largest trees (around 24 inches d.b.h.) are much more frequent in the northwest quarter of the woods than anywhere else. The densest collection of these large beeches is found around the pond located just southeast of the intersection between the northern east-west trail and the western north-south trail. Pole beeches appear to be more randomly distributed in the woods, and the relative abundance of these smaller trees explains their low dominance value. Our conjecture is that large individuals may have been the targets of early cuttings which, in addition to removing

wood for fuel and lumber, were intended to remove "undesirable" species to allow faster growth of more valuable trees.

Along with beech, red maple, and sugar maple, four additional species are dominant members of the overstory vegetation. These taxa which clearly show their importance in the sampling data are *Quercus rubra*, *Fraxinus americana*, *Tilia americana*, and *Prunus serotina*. They are widely distributed in the woods and precise descriptions of their favored habitats are not generally possible. Red oak, however, is generally found on the drier sites which are most prevalent in the northern third of the woods.

Because of the historically recent disturbances previously described, it is obvious that the woods could have a different character than might be the case if it had been insulated from major man-made disturbances for several generations of the dominant trees. Although the beech-maple community may not normally be maintained under protected conditions, it seems clear that the woods is changing as a result of protection from disturbance. A striking example of this change is cottonwood (*Populus deltoides*), which is represented by only a few large individuals; in the course of this study, two of these trees have blown down. In the absence of additional disturbance, it is unlikely that this species will much longer be represented in the woods. Although cottonwood is relatively short-lived, this disturbance-dependent presence in the beech-maple community may also account for such species as *Fraxinus americana*, *Liriodendron tulipifera*, and *Sassafras albidum*. A number of species which seem to be the least disturbance-dependent are apparently mast-fruited, while the disturbance-related species produce fruit more regularly.

Due to the long history of selective cuttings reported for both Baker and Sanford in the Annual Reports of the State Board of Agriculture, a detailed comparison of the density, dominance, and frequency values both within and between these two areas would be of limited value in any attempt to elucidate the structure of a virgin, mid-Michigan, beech-maple climax community. In contrast to Baker and Sanford, Toumey Forest has not been cut for at least 125 years (Schneider, 1966).

Perhaps the most striking value in the point quarter data is the high density of sugar maple in Toumey as compared to its density in Baker and Sanford. The higher density of sugar maple is also responsible for the large difference between the total absolute density of Toumey and the value for the other two woods. Schneider's (unpublished) d.b.h. table for his 100% inventory of Toumey shows that the large density value for sugar maple is due to an abundance of trees in the smaller diameter classes. In Toumey there is an average of 361 sugar maples per acre between one and two inches d.b.h. This is 68% of the total number of individuals of this species in that woods. In contrast, only 18% of the sugar maples encountered in the sampling in Baker were in this size class, giving an estimated 31 trees per acre. Sanford sampling data gave 64 trees per acre in the one- to two-inch size class. From our observations, sapling sugar

TABLE 1. Absolute density, dominance, frequency, and average dominance values of 23 woody species 1 in. or greater d.b.h. in 3 mid-Michigan beech-maple woodlots.

Species	Absolute density (individuals/acre)			Absolute dominance (sq. feet/acre)			Absolute frequency (in percent)			Average dominance (sq. feet/individual)		
	Baker	Sanford ¹	Toumey ²	Baker	Sanford	Toumey	Baker	Sanford	Baker	Sanford	Baker	Toumey
<i>Acer saccharum</i> ³	173.2	206.4	533.1	67.7	48.7	73.0	75.5	81.0	.39	.24	.39	.14
<i>Fagus grandifolia</i>	40.9	28.6	44.8	15.5	36.7	27.1	27.9	24.0	.38	1.28	.60	.60
<i>Quercus rubra</i>	17.3	10.2	10.5	32.4	7.5	5.9	14.9	9.0	1.87	.73	.56	.56
<i>Fraxinus americana</i>	23.6	30.7	41.6	25.0	5.9	3.5	19.0	25.0	1.06	.19	.08	.08
<i>Tilia americana</i>	24.3	28.6	7.7	21.7	8.4	4.5	15.6	25.0	.89	.28	.59	.59
<i>Acer rubrum</i>	62.3	1.0	0.0	20.1	2.9	0.0	40.8	1.0	.32	2.88	.00	.00
<i>A. saccharinum</i>	0.0	26.6	n.p.	0.0	45.9	—	0.0	14.0	.00	1.73	—	—
<i>Prunus serotina</i>	17.3	2.0	11.2	16.3	3.2	2.2	12.2	2.0	.94	1.93	.19	.19
<i>Quercus alba</i>	2.1	0.0	0.5	5.4	0.0	0.3	2.0	0.0	2.60	.00	.52	.52
<i>Ulmus americana</i>	1.4	13.3	0.8	0.1	3.3	0.9	1.4	12.0	.05	.25	1.16	1.16
<i>U. rubra</i>	0.7	2.0	n.p.	0.1	0.1	—	0.7	2.0	.16	.03	—	—
<i>U. thomasi</i>	n.p. ⁴	0.0	22.6	—	0.0	1.2	—	0.0	—	.00	.05	.05
<i>Robinia pseudo-acacia</i>	2.8	1.0	n.p.	2.7	0.0	—	2.0	1.0	.98	.00	—	—
<i>Fraxinus nigra</i>	2.7	3.1	0.0	1.3	3.8	0.0	2.7	2.0	.48	.02	.00	.00

<i>Quercus muehlenbergii</i>	0.0	3.1	n.p.	0.0	3.8	—	0.0	2.0	.00	1.21	—
<i>Q. macrocarpa</i>	0.0	2.0	n.p.	0.0	1.2	—	0.0	2.0	.00	.58	—
<i>Liriodendron tulipifera</i>	0.7	n.p.	n.p.	2.6	—	—	0.7	—	3.71	—	—
<i>Carya cordiformis</i>	3.5	1.0	1.8	0.1	0.0	0.2	2.0	1.0	.03	.02	.10
<i>Sassafras albidum</i>	7.7	2.0	n.p.	1.9	0.5	—	7.5	2.0	.25	.24	—
<i>Carpinus caroliniana</i>	2.7	18.4	0.3	0.5	0.8	0.0	2.7	13.0	.18	.04	.04
<i>Ostrya virginiana</i>	17.3	16.4	30.1	0.4	0.5	1.0	10.9	14.0	.02	.03	.03
<i>Hamamelis virginiana</i>	5.6	1.0	0.4	0.1	0.0	0.0	5.4	1.0	.00	.00	.01
<i>Zanthoxylum americanum</i>	0.0	0.0	28.8	0.0	0.0	0.2	0.0	0.0	.00	.00	.01
Total ⁵	407.5	408.7	739.7	217.8	173.7	122.5					

¹These data do not agree exactly with those published by Beaman (1970a) on the Sanford Natural Area. A student involved in that project made several computational errors. The correct analysis of his field data is presented here.

²This information is derived from a 100% inventory of Toumey Forest (unpublished data used with permission of Dr. G. Schneider). Since frequency determination is characteristic of the sampling method, it was not possible to compute frequency values compatible with those derived from the point-centered quarter analysis of Baker and Sanford. Because of this we were also unable to derive an importance value for the trees in Toumey, and this is omitted from Table 2.

³We have included black maple in this species for both the Sanford and Baker data. Schneider (1966) mentioned the presence of black maple in Toumey, but no individuals were distinguished from sugar maple in his 1970 tally.

⁴Not present in the woods.

⁵The totals presented here include a contribution from several additional woody species, either shrubs of low density that have reached 1 in. d.b.h. or trees of very low density and dominance encountered in sampling but contributing little to the vegetation.

TABLE 2. Relative density, dominance, frequency, and importance values of 23 woody species 1 in. or greater d.b.h. in 3 mid-Michigan beech-maple woodlots.

Species	Relative density (in percent)			Relative dominance (in percent)			Relative frequency (in percent)		Importance value	
	Baker	Sanford	Toumey	Baker	Sanford	Toumey	Baker	Sanford	Baker	Sanford
<i>Acer saccharum</i>	42.5	50.5	72.1	32.0	28.0	60.8	30.4	31.5	104.9	110.9
<i>Fagus grandifolia</i>	10.0	7.0	6.0	7.1	21.1	6.0	11.2	9.3	28.4	37.5
<i>Quercus rubra</i>	4.3	2.5	1.4	14.9	4.3	4.9	6.0	3.5	25.2	10.3
<i>Fraxinus americana</i>	5.8	7.5	5.6	11.5	3.4	2.9	7.7	9.7	24.9	20.6
<i>Tilia americana</i>	6.0	7.0	1.0	10.0	4.8	3.8	10.0	9.7	22.2	21.6
<i>Acer rubrum</i>	15.3	0.3	0.0	9.2	1.7	0.0	16.5	0.3	41.1	2.3
<i>A. saccharinum</i>	0.0	6.5	—	0.0	26.4	—	0.0	5.4	0.0	38.4
<i>Prunus serotina</i>	4.3	0.5	1.5	7.5	1.9	1.8	4.9	0.8	16.6	3.1
<i>Quercus alba</i>	0.5	0.0	0.0	2.5	0.0	0.2	0.8	0.0	3.8	0.0
<i>Ulmus americana</i>	0.3	3.3	0.0	0.0	1.9	0.7	0.6	4.7	0.9	9.8
<i>U. rubra</i>	0.2	0.5	—	0.0	0.0	—	0.3	0.8	0.5	1.3
<i>U. thomasii</i>	—	0.0	3.1	—	0.0	1.0	—	0.0	—	0.0
<i>Robinia pseudo-acacia</i>	0.7	0.3	—	1.2	0.0	—	0.8	0.3	2.7	0.6
<i>Fraxinus nigra</i>	2.8	0.8	0.0	0.6	2.2	0.0	1.1	0.8	2.4	3.7
<i>Quercus muehlenbergii</i>	0.0	0.8	—	0.0	2.2	—	0.0	0.8	0.0	3.7
<i>Q. macrocarpa</i>	0.0	0.5	—	0.0	0.7	—	0.0	0.8	0.0	2.0
<i>Liriodendron tulipifera</i>	0.2	—	—	1.2	—	—	0.3	—	1.7	—
<i>Carya cordiformis</i>	0.9	0.3	0.2	0.0	0.0	0.2	0.8	0.3	1.7	0.6
<i>Sassafras albidum</i>	1.9	0.5	—	0.9	0.3	—	3.0	0.8	5.8	1.6
<i>Carpinus caroliniana</i>	2.8	4.5	0.0	0.2	0.4	0.0	1.1	5.1	2.0	10.0
<i>Ostrya virginiana</i>	4.3	4.0	4.1	0.2	0.3	0.8	4.4	5.5	8.8	9.7
<i>Hamamelis virginiana</i>	1.4	0.3	0.0	0.0	0.0	0.0	2.2	0.3	3.6	0.6
<i>Zanthoxylum americanum</i>	0.0	0.0	3.9	0.0	0.0	0.2	0.0	0.0	0.0	0.0

maples appear to be very abundant in Toumey and distributed throughout the woods. In Baker the sugar maples of this size appear to have a more contiguous distribution. In certain areas one- to two-inch sugar maples are quite dense, but in most of the woods they seem to be less common than in Toumey. If the point-quarter data do accurately reflect a lower density in Baker and Sanford, it is interesting to speculate on how these density differences relate to the separate histories of the three areas.

The difference in density, however, may in part be an aberration resulting from use of the point-centered quarter technique as the method for estimating the density of these small trees. A 100% inventory will, of course, count every tree in the woods within the size classes being studied while the point-centered quarter sampling will tend to underestimate the density of a species with a contiguous distribution (Mueller-Dombois & Ellenburg, 1974).¹

Between 1973 and 1976, we took 43 increment cores from the largest trees in the woods. The cores show that most of the trees are between 70 and 123 years old. Six beeches are considerably older, with estimated ages ranging from 171 to 269 years. Conspicuous and corresponding cycles of slow and fast growth are indicated by annual ring widths. The most striking cycles are a period of fast growth from around 1894 to 1907, and a period of very slow growth from around 1927 to 1940.

Among the most outstanding trees in the woods are several massive individuals of *Liriodendron tulipifera* (tulip tree) scattered through the area and around seven 17–20 inch d.b.h. individuals of *Nyssa sylvatica* (black gum), most of which occur at the periphery of the western pond located just south of the northern east-west trail. Both of these species are near the northern edge of their range in central Michigan. P. A. Herbert (head of the Department of Forestry at the time) recalled a 30-inch d.b.h. black gum tree that was cut in the woods in 1934 or 1935 (pers. comm.).

Although most herbaceous species are scattered throughout the woods with no apparent strict habitat preferences, some species distributions are correlated with local edaphic conditions, especially soil type and moisture. The diversity of the herbaceous flora is greatest in the south-central woods where foot traffic and subsequent compaction of the soil have been minimal. The soils there are loamy and moist, while in the northern third of the woods they are generally drier and more compressed, probably as a result of trampling. The herbaceous vegetation in several areas in the northern woods has been largely decimated from this overuse. The high taxonomic diversity of the south-central woods may in part be due to the mosaic of microhabitats created by the large number of tip-up mounds in the area (see Flanders, 1971).

There are areas in the woodlot where the floristic complement is

¹One problem with the point-centered quarter technique is the variable accuracy with which it eliminates total absolute density. This statistic is of paramount importance because the individual species densities are computed from it. We checked the total density in Baker for trees one inch d.b.h. or larger by taking a census in plots which together totaled an area of 2.9 acres. This inventory gave a density value of 402 trees per acre.

characteristic and distinctive. The ponds have several associated species which are otherwise rare or unknown in drier parts of the woods. *Cephalanthus occidentalis*, *Ilex verticillata*, *Impatiens noli-tangere*, and *Pilea pumila* are good examples of such plants, along with the obvious aquatics *Calla palustris*, *Typha* spp. and *Lemna minor*. *Lindera benzoin* is also common in the vicinity of the ponds, but it is also abundant in patches in wet depressions in the central woods.

The soil in the southwest corner of Baker Woodlot is noticeably sandy and drier than most of the soils in the woodlot. *Aralia nudicaulis*, *Carex pensylvanica*, and *Prenanthes altissima* are characteristic inhabitants of the area. Both Bogue (1903) and Conant (undated) mention the occurrence of fires in this part of the woods, and these may have had some direct relationship with this somewhat peculiar soil type. In contrast to the dry area in the southwest corner, other portions of the southern woods, especially to the east, are seasonally inundated by several inches of water. These low areas are concentrated in the vicinity of the large pond in the southeast woods.

PRESERVATION

Since the forests which originally covered the university campus have been reduced to small isolated patches, it would seem reasonable that decisions concerning the continued existence and management of the remaining tracts take into consideration the question of how much forest should be preserved and in what condition. There are many aspects to this question, but the most important concern the characteristics of the forest itself. If community preservation alone were the reason for not eliminating the remaining patches of forest, it would need to be determined what area of forest would be necessary to satisfy the goal of preservation: the more heterogeneous the forest, the larger the area necessary to preserve it. Species composition is one of the ways in which communities can be characterized. Now that there are three local woodlots with complete checklists (Beaman, 1970b; Frye, 1976; Stevens & Beach, in press), it is possible to examine the homogeneity of the local beech-maples communities.

Table 3 summarizes the species composition of three local woodlots, Baker, Sanford, and Sandhill (a 44 acre beech-maple woods a few miles south of Baker). Because the herbaceous flora of Toumey is poorly known, it was not possible to include that woods in this comparison. The status of each species was determined by reference to Gleason & Cronquist (1963), Voss (1972), and notations in the individual checklists. A total of 494 vascular plant species occurs in one or more of these three woodlots (for this compilation, sugar and black maple are counted as separate species). Of this total, Baker contains 75%, Sanford 72%, and Sandhill 52%. Of more significance are the native forest species, many of

TABLE 3. Vascular plant species richness of local woodlots. Absolute number and relative proportion (parentheses) of species in each woodlot contained within the categories indicated.

Woodlot	Native forest species	Introduced species	Planted species	Other ¹	Total (100%)
Sanford Nat. Area	189(53%)	67(19%)	4(1%)	97(27%)	357 ²
Sandhill Woodlot	155(61%)	39(15%)	2(1%)	59(23%)	255
Baker Woodlot	198(53%)	73(20%)	10(3%)	90(24%)	372

¹Includes native non-forest species (primarily found in margins and disturbed places), species included in checklists but not occurring within woodlot boundaries, and species noted in checklists but not documented by specimens.

²Includes two additional species not recorded by Beaman (1970b) and noted by Stevens and Beach (in press).

which would not be found locally if the woodlots were not preserved. There are a total of 248 native forest species found in the three areas, Sandhill having 63% of them, Sanford 76%, and Baker 80%.

It is clear then that the distributions of the native forest species are such that no one campus woodlot contains more than 80% of the species of the original forest (probably significantly less than 80%, since studies of additional campus woodlots will increase the total number of these species and, of course, certain species may have been lost from the area entirely).

There are 139 native forest species, or over half the total, missing in one or two of these woods. Some of these are rare even where they occur and are in danger of being lost from the local flora. Examples are *Nyssa sylvatica*, *Medeola virginiana*, *Cypripedium calceolus*, and *Orchis spectabilis* found only in Baker, *Dirca palustris*, *Stachys tenuifolia*, and *Arisaema dracontium* found only in Sanford, and *Carya ovalis* and *Monotropa uniflora* found only in Sandhill. Other species are rather common in some woods but absent in others. Examples are *Dicentra canadensis* and *D. cucullaria*, which are common in Sanford and Sandhill but absent from Baker. At this time it can only be speculated whether these species discontinuities are reflections of the ranges of the species in the original forest or whether they are an artifact of the histories of the individual woodlots.

Thus it can be documented that protection of more than one campus woodlot is necessary in order to preserve a reasonably complete sample of the original forest vegetation. This is especially true when considering rarer species. It should be noted that two species on the state and federal threatened plant lists (Wagner et al., 1977; Ayensu & DeFilipps, 1978), *Hydrastis canadensis* and *Panax quinquefolius*, are locally discontinuous, occurring in Baker and Sanford but not in Sandhill.

The vegetation of Baker Woodlot is still responding to timber harvesting and other disturbances of the past and probably will continue to do so for decades in the future. Even without additional human

disturbance, we would expect the flora of the woods to change as the community increases in age. Although a few aggressive weeds, exotic ornamentals, or even native woodland species might still find their way into an undisturbed woods, the probable outcome of complete protection would be gradual loss of species diversity as the non-woodland plants are gradually excluded. Complete protection, however, is neither feasible nor even desirable for Baker Woodlot. Increased and uncontrolled use would surely lead to more serious degradation of the woods, through soil compaction, loss of rare or sensitive woodland species, introduction of additional weeds, and general defacement of the environment. The challenge will be to adapt the management of Baker Woodlot to the changing needs and aspirations of the university community.

In the early years of the college, the local forests served as sources of heating fuel and lumber for campus construction. As the original forests on campus and elsewhere in Michigan were being rapidly decimated around the turn of the century, Professor William James Beal called out for protection of the remaining college woodlands. Subsequently selective cuts were used to demonstrate to Michigan landowners a more economically (and ecologically) sound method for utilizing woodlands without destroying them. In the latter part of the first half of this century, Professor Paul A. Herbert envisioned broader values of the woods and championed yet more conservative policies of utilization. He recognized the need for leaving areas that were of no value for timber production, such as the ponds, as examples of natural forest conditions. Since Herbert's time many faculty and students have realized the value of the woods for research, instruction, and casual recreation. In short, as the values and needs of the university community have changed, so has the role of Baker Woodlot.

We are now at a crossroads of conflicting and changing demands upon the woods. With current levels and types of use, deterioration is already obvious. Usage is certain to increase as the campus expands southward. The burden is on the guardians of the woodlot to consider carefully the extent and nature of use and to apply protective measures. Biologically, Baker Woodlot is the most valuable piece of land on campus, yet it receives less attention and protection than the average campus parking lot.

As the Michigan population increases and even more land goes into urban development, woodland areas will become increasingly precious. Excessive and unwise usage would decrease and eventually eliminate the natural values. Further, it is clear from our study that no single one or even a few protected campus woods will serve to preserve the essence of the original forest; they are simply too small and too floristically different, with too many demands made upon them. It would be our hope, indeed our strong recommendation, that all campus natural areas be managed by an administrative unit sympathetic to conservation ethics and able to take into consideration the numerous, often conflicting and changing needs of the university community.

SUMMARY

Baker Woodlot is a beech-maple woods on the campus of Michigan State University. Sugar maple is the dominant species in the overstory, followed in importance by red maple and beech. The abundance and distribution of the species in the forest reflect the long history of selective cutting. The southern half of the woodlot is taxonomically richer than the north, probably for two reasons: (1) The soils of the southern woods are more moist and microtopographically diverse, and thus may support more ecologically sensitive plants. (2) The southern woods has been less subject to foot traffic which destroys the herbaceous vegetation directly and also compacts the loamy soil making it uninhabitable for many woodland herbs. Analysis of the floras of three mid-Michigan beech-maple woodlots shows that of 248 native forest species occurring locally, 139 are discontinuously distributed, being represented in only one or two of the areas. Of the 248 native species, Baker has 198, including 35 which occur only in this woods.

REFERENCES

- Ayensu, E. S. & R. A. DeFilipps. 1978. *Endangered and Threatened Plants of the United States*. Smithsonian Institution and World Wildlife Fund, Inc., Washington, D. C. xv + 403 pp.
- Beach, J. H. & W. D. Stevens. 1979. A study of Baker Woodlot. I. Physical and historical description. *Mich. Bot.* 18:123-136.
- Beaman, J. H. 1970a. A botanical inventory of Sanford Natural Area. I. Physical environment. *Mich. Bot.* 9:116-139.
- . 1970b. A botanical inventory of Sanford Natural Area. II. Checklist of vascular plants. *Mich. Bot.* 9:147-164.
- Bogue, E. E. 1903. Report of the Forestry Department. *Ann. Rep. Sec. St. Board Agr. Mich.* 42:42-46.
- Braun, E. L. 1950. *Deciduous Forests of Eastern North America*. Blakiston, Philadelphia. 596 pp. + map.
- Conant, H. E. Undated [1930]. A study in phenology and migration as exemplified [sic] in the woody vegetation of Woodlot 17, at Michigan State College. Unpubl. Beal-Darlington Herbarium files, Mich. State Univ. 28 pp.
- Cottam, G. & J. T. Curtis. 1956. The use of distance measures in phytosociological sampling. *Ecology* 37(3):451-460.
- Flanders, R. A. 1971. *Temporal Associations Among Woodland Plants in Southern Michigan*. M. S. thesis. Dept. of Botany and Plant Pathology, Mich. State Univ. vi + 70 pp.
- Frye, D. M. 1976. A botanical inventory of Sandhill Woodlot, Ingham County, Michigan. II. Checklist of vascular plants. *Mich. Bot.* 15:195-204.
- Gleason, H. A. & A. Cronquist. 1963. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. Van Nostrand, Princeton. li + 810 pp.
- Mueller-Dombois, D. & H. Ellenburg. 1974. *Aims and Methods of Vegetation Ecology*. Wiley, New York. xx + 547 pp.
- Schneider, G. 1966. A twenty-year ecological investigation in a relatively undisturbed sugar maple-beech stand in southern Michigan. *Res. Bull. 15., Mich. Agr. Exp. Sta.* 61 pp.
- Stevens, W. D. & J. H. Beach. 1980. A study of Baker Woodlot. III. Checklist of vascular plants. *Mich. Bot.* 19:in press.
- Voss, E. G. 1972. *Michigan Flora: A Guide to the Identification and Occurrence of Native and Naturalized Seed-Plants of the State. Part I: Gymnosperms and Monocots*. Cranbrook Inst. Sci. Bull. 55 and Univ. of Mich. Herbarium. 488 pp. + 8 pl.
- Wagner, W. H. et al. 1977. *Endangered, threatened, and rare vascular plants in Michigan*. *Mich. Bot.* 16:99-110.

REVIEW

A TAXONOMIC MONOGRAPH OF EQUISETUM SUBG. EQUISETUM, by Richard L. Hauke. Nova Hedwigia 30:385-455. 1978. Braunschweig. J. Cramer.

Botanical Michiganders will find this monograph especially interesting. Six of the eight species of true horsetails of the world grow in Michigan, as well as the only well-known horsetail hybrid. In the northern Great Lakes region as a whole these plants are conspicuous elements of the flora. Professor Hauke, of the University of Rhode Island, began his studies of horsetails and scouring rushes at Douglas Lake in 1952 and has since become a leading authority on them. He published his monograph on scouring rushes (subg. *Hippochaete*) in 1963, and the present one, which deals with the horsetails (subg. *Equisetum*), completes his over-all taxonomic treatment of the small but widespread genus *Equisetum*, the last representative on earth of a once major element of the world's vegetation.

This monograph, including such subjects as morphology, anatomy, gametophytes, paleobotany, geography, ecology, culture, and economic value, is a mine of information, well documented in an extensive bibliography. But it is too short. Indeed the presentation is almost telegraphic. It would have been useful, for example, if Professor Hauke had summarized some of his other work on horsetails here, rather than just citing it. Valuable studies on *Equisetum arvense* are dismissed by one sentence: "This species has been separately discussed in Hauke, 1966." The section on hybrids is too brief; it would have been useful if each hybrid had been discussed and evaluated, including Hauke's own work on *E. × litorale*. The paragraph suggesting that the character combinations in subgenus *Equisetum* may be due to ancient reticulate evolution is so scanty in its argument as to be practically worthless.

Much more space (8½ pages) is taken up by outlining successive classifications of the horsetails from 1829 onward. The skimpy evidence, to say nothing of meager conceptual sophistication, that went into classifications of all plant groups in those days makes them mere curiosities, quaint relics of a time of scant knowledge. If authors of monographs feel it necessary to display the histories of classification from the first feeble attempts onward, I suggest that they use a tabular style, such as that illustrated by Becker for angiosperms (Taxon 22:19-50. 1973).

Coming back to the problem of brevity in this monograph, I have the feeling that the author was influenced by the exigencies of today's expensive publication. The pressure to cut down the length of taxonomic papers is one that we all do feel, but I hope that it will not have a deleterious effect in the long run. Granting agencies, such as the National Science Foundation, must give serious consideration to this problem, especially at the present time when taxonomic monographs are in demand more than ever—by ecologists, environmentalists, land managers, and the general scientific public. A fine monograph, like this one by a leading authority, could have been expanded in length and increased in usefulness.

Great Lakes naturalists will be interested to learn, as I was, that there are several potential hybrids yet to be found in this area. *Equisetum × litorale*, the striking combination of common horsetail, *E. arvense*, and water horsetail, *E. fluviatile*, well known in our area, combines widely different characteristics of its parents. Professor Hauke lists six more hybrids that could turn up in our area, including such bizarre combinations as *E. arvense × palustre* and *E. pratense × sylvaticum*.

Considerable interest will be aroused by Hauke's conclusion that the great horsetail, *E. telmateia* ssp. *braunii*, so characteristic of the far west, once occurred in the Great Lakes, even though many botanists have regarded this as erroneous. Great horsetail was recorded no less than four times during the last century and a half, and Hauke concludes that the records are probably valid. Is it possible that this striking horsetail still exists somewhere in our region? Perhaps one of us will be walking along a damp sandy flat in the Upper Peninsula and . . . —W. H. Wagner, Jr.

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INVESTIGATIONS ON SEED DISPERSAL IN THE
NAKED MITERWORT, *MITELLA NUDA*

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Mechanisms by which propagules are ejected from cup-shaped capsules by the impact of raindrops were recognized by Martin (1927) in his work on the fungus, *Crucibulum vulgare*. Splash cup mechanisms have also been found in mosses, liverworts, other fungi, and a number of flowering plants, including members of several genera of Saxifragaceae. *Mitella diphylla*, a North American saxifrage with an erect raceme bearing five to 20 seed-filled capsules on stiff pedicels, was examined by Savile (1953) following a rainstorm and was found to have empty capsules. After discovering in a laboratory experiment that seeds could be splashed off parent plants by falling water drops, Savile concluded that a splash-cup mechanism was operating in *M. diphylla*. Based on strong morphological similarities in capsule structure, he postulated that rainfall was also principally responsible for seed dispersal in a more northerly species, *Mitella nuda* (Fig. 1, 2). The purpose of my research was to test this hypothesis. A field experiment was designed to determine whether rain falling on a plant actually contributes to dispersal of its seeds. A side experiment was performed in an attempt to isolate the effects of wind and larger animal vectors. Savile's laboratory tests on *Mitella diphylla* were repeated on *M. nuda* to determine whether simulated rainfall could produce the same degree of dispersal.

Field Experiment: Field manipulations were carried out in a one-acre segment of Reese's Swamp at the north end of Burt Lake (Cheboygan County, Michigan), a wet forest with trees and herbs typical of northern latitudes. The dominant trees were *Thuja occidentalis*, *Abies balsamea*, and *Betula papyrifera*. *Mitella nuda* shared the herbaceous layer with *Aralia nudicaulis*, *Thelypteris palustris*, *Clintonia borealis*, *Coptis trifolia*, *Actaea rubra*, *Trientalis borealis*, *Acer rubrum* seedlings, *Maianthemum canadense*, *Linnaea borealis*, and *Galium triflorum*.

On July 2, 1978, 100 *Mitella nuda* individuals in fruit were selected, flagged, and the seeds in each capsule counted (using a handlens). Each plant was assigned to one of four treatments:

1. A raincover, comprised of a wide sheet-metal cone (21 cm in diameter) supported by two wooden stakes driven into the ground and standing 21 cm above ground, was centered over each plant to prevent

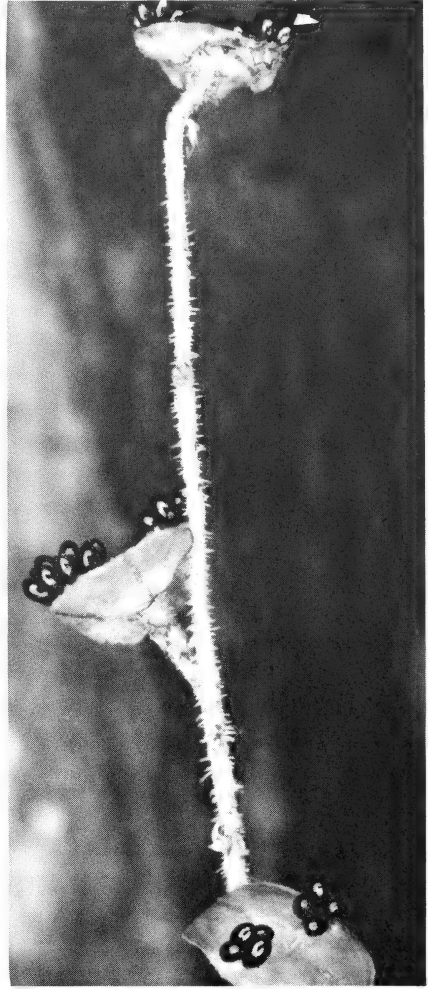
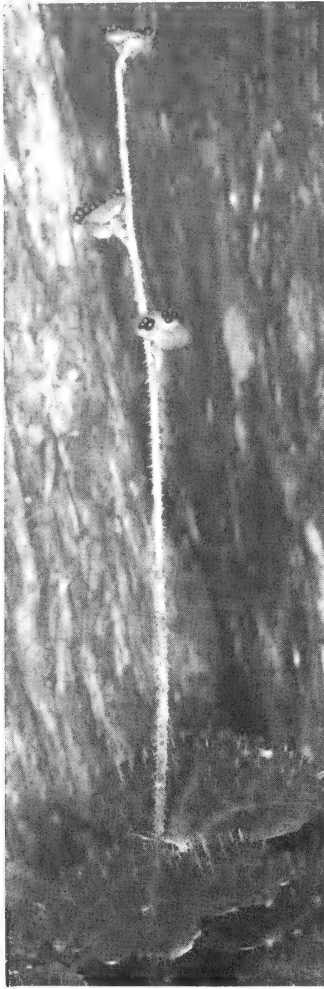


Fig. 1. *Mitella nuda* in fruit. Fig. 2. Enlarged view of capsules and seeds shown in figure 1. (Both photographed by Robert J. Ambrose).

raindrops from hitting the capsules. In all cases the raincover rose well above the height of the plant.

2. A metal cylindrical barrier (15.5 cm diameter, 13 cm high), made from a no. 10 can by removing the top and bottom, was used to enclose single plants. Each barrier was fastened to the ground with stakes; in all cases it exceeded the height of the plant. The barrier was designed to reduce the impact of surface wind on the capsules and to exclude possible animal dispersers, notably small mammals.

3. A clear plastic terrarium cover (21 cm diameter, 26 cm high) was centered over each plant and fastened to the ground with stakes. The

terrarium cover shielded a plant from rain, wind, and all but small, crawling or burrowing animal vectors. This sub-experiment produced a drying effect and was disregarded.

4. No artificial treatment allowed for a control.

A total of 25 raincovers, 25 barriers, 12 terrarium covers, and 38 controls were used.

Treatments were not assigned randomly. Instead they were assigned so that plants with high, medium, and low initial numbers of seeds were distributed approximately equally over the four treatments. This was done by ranking the plants from highest initial seed number to lowest initial seed number. Treatments were then assigned in the same repeated sequence. Figure 3 gives the frequency distribution of initial seed number in each of the three treatments analyzed. The mean number of seeds per plant was similar in all three treatments: control—22.31, raincover—21.85, barrier—22.59.

The seeds on each plant were counted on 12 occasions between July 2 and August 6. The intervals between counts were irregular—varying from one to five days. Only the first and last counts were used in the final analysis, but intermediate monitoring gave some feeling for the rate of seed loss. Efforts were made to count seeds on days immediately following periods of rainfall.

For the final analysis the number of seeds present on each plant on August 6 was subtracted from the initial number of seeds on that plant to find the number of seeds lost. Number lost was plotted against initial number in order to see whether there was a correlation (see Figure 4). There was none (correl. coeff. = .065 with 73 df). In other words, plants with small initial numbers of seeds tended to lose as many seeds as plants with high numbers of seeds during the course of the experiment. There was 100% dispersal on only two plants; all others retained at least one seed. With the determination that number of seeds lost is independent of initial number of seeds, it was possible to compare numbers of seeds lost on each plant between treatments rather than percentages. A Mann-Whitney U test was used to test for differences between each treatment and the control group.

Laboratory experiment: On August 10, ten plants were removed from a nearby site, planted in finger bowls (with as little disturbance to roots as possible), watered, and brought into the laboratory. It was difficult to ascertain the degree of seed ripeness. However, since all capsules in the study population had been open for at least a month and dispersal was in progress on many of them, the seeds on the experimental plants were assumed to be ready for dispersal. Several hours after transplanting, each capsule of each plant was subjected to a succession of five drops of water falling from a pipette mounted on a ring stand 3½ ft. above the middle capsule. Seeds per capsule were recorded before and after each test to determine whether any seeds had been splashed off. Two of the ten plants were subjected to an additional five drops of water after a short rest period. This operation was performed to check for the possibility that the adhesive binding seed to capsule weakens after exposure to water.

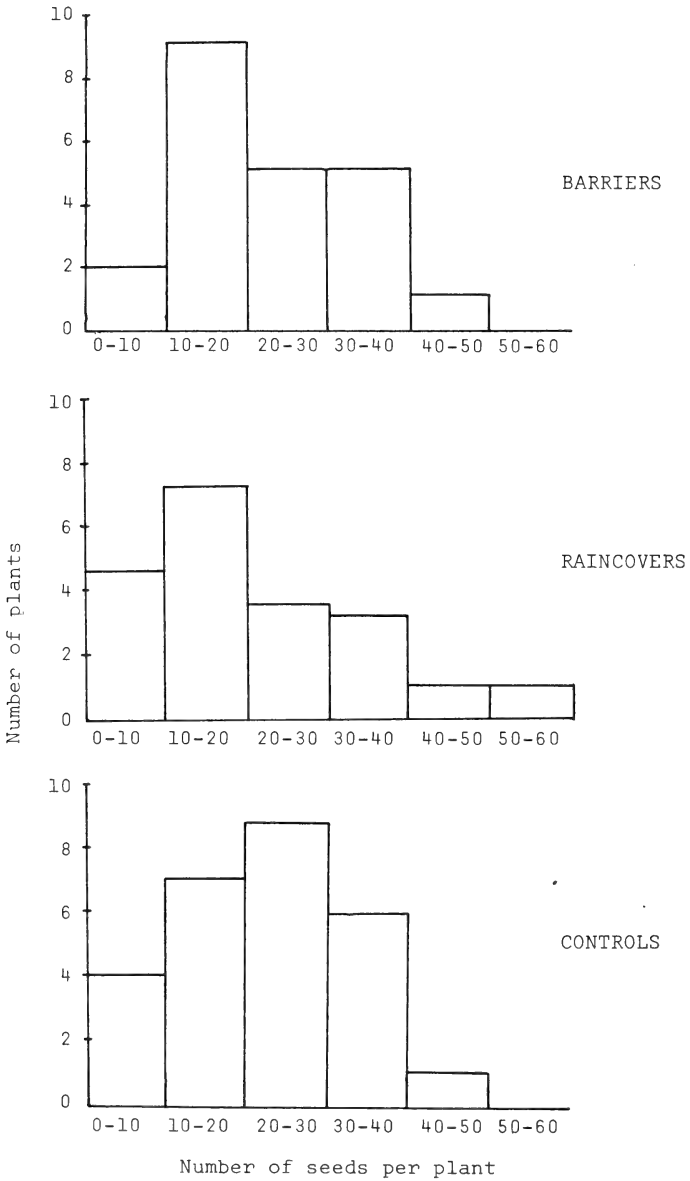


Fig. 3. Frequency diagrams showing the distribution of initial seed number in the three treatments.

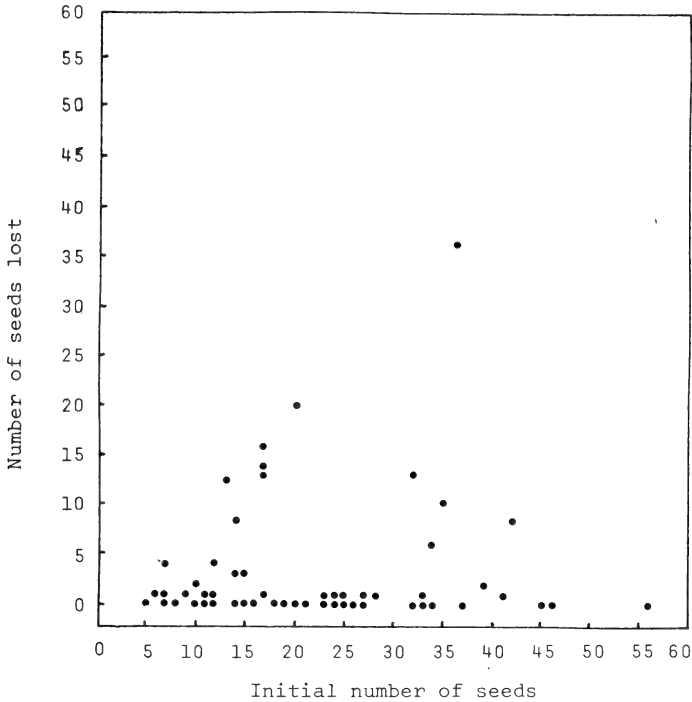


Fig. 4. Relationship between initial number of seeds per plant and number of seeds lost per plant by August 6. Each point represents one plant, except on the x-axis where one point represents up to three plants.

This experiment followed the basic idea of Savile's tests on *Mitella diphylla*. However, except for height above the plant, he gave no details about how the drops were administered and in what number. He brought plants into the laboratory and kept them in water for 48 hours before the tests, presumably to keep the stems turgid. Owing to time restrictions, I could not do this. Since the plants were fresh and watered, loss of turgidity was not a problem; in fact, a more natural situation was probably achieved in this way.

Results: field experiment: A total of 68 plants was used in the final analysis. All 12 under plastic covers had been disregarded and 20 more were eliminated because the seeds had dried out and could not be accurately counted or the plants were missing. Of these 68 plants, 26 were controls, 20 were under rain covers, and 22 were inside barriers. Thirty-two plants had lost at least one seed. The number of seeds lost from each plant is given below (each number representing a single plant):

BARRIER		CONTROL		RAINCOVER	
8	1	10	0	0	0
0	0	0	1	0	36
1	1	1	1	0	0
0	1	0	0	0	0
2	0	14	0	3	0
3	0	1	0	0	6
0	1	0		19	
0	1	0		0	
0	0	0		0	
13	13	0		1	
16	2	20		0	
1	4	12		4	
0	8	1		1	
0		0			

A Mann-Whitney U test showed no significant difference between the number of seeds lost in plants under raincovers and that lost in the control group ($p=0.24$). The number of seeds lost in plants surrounded by barriers was not significantly different than in the control group ($p=0.52$).

Results: laboratory experiment: No seeds were lost from the ten plants subjected to five drops of simulated rain or from two plants tested twice.

Discussion: Results show that in *Mitella nuda* the exclusion of rainfall does not affect the number of seeds dispersed from a parent plant. Shielding from surface wind and from disturbance and possible removal of seeds by some animals also does not inhibit dispersal. This study eliminated wind, rain, and larger animals as dispersal agents but did not answer the question of how the seeds actually are dispersed. Dispersal by ants remains a possibility. The barriers set up around plants did not fit closely enough to the ground to prevent entrance by ants. The seed of *Mitella nuda* does not conform to the standard pattern of ant-dispersed seeds. Such seeds typically have an attached elaiosome, or oil body, which is removed and presumably eaten after the seed has been carried away from the parent plant (van der Pijl, 1969). Nothing resembling an elaiosome has been seen on the seed of *Mitella*. Van der Pijl (1969) does cite other cases in which the edible ant-attractant is present throughout the fleshy part of the seed (*Allium ursinum*, *Cyclamen*, etc.) or in the seed coat (*Myrmecodia*).

Another possibility is that an abscission layer forms between seed and capsule, and the seed merely falls off. Surface water from heavy rainfall could then carry the seeds away from a zone of competition with the parent. This idea would be supported by evidence that *Mitella* seeds do not germinate until spring when they could take advantage of movement by water from melting snow.

Savile (1953) used capsule morphology to postulate evolutionary relationships among certain genera in the Saxifragaceae: The efficiency of the splash-cup was presumed to increase in the progression from primi-

tive to more advanced genera, and *Heuchera*, with a very deep, narrow-throated, and inefficient capsule, was thought to be the genus in which the splash-mechanism arose. Two evolutionary lines came from *Heuchera*, one of which led to the shallower but well-developed capsule of *Mitella*. Following this line of reasoning, it appears that the trend has continued in *Mitella*. Both *M. nuda* and *M. diphylla* possess cup-shaped capsules. As the seeds ripen within it, the capsule of *M. diphylla* remains cup-shaped while that of *M. nuda* flattens into a more plate-like structure. A reasonable evolutionary sequence, based on this evidence alone, would presume *M. diphylla* to display the more primitive characteristic and *M. nuda* to show a derived state.

Evidence from my research and from morphological differences between *M. nuda* and *M. diphylla* suggests an adaptive shift in dispersal mechanism within the genus. The extension of Savile's evolutionary progression given above further implies that the shift has occurred from a splash-cup dispersal mechanism in *M. diphylla* to an unknown mechanism in *M. nuda*, rather than vice versa. Because the comparative biology of dispersal mechanisms is rarely studied, no examples of adaptive radiation in entire genera are known (Stebbins, 1971). The small genus *Mitella* could provide an excellent opportunity to study such adaptive radiation and to explore the selective pressures operating on dispersal mechanisms in different habitats.

SUMMARY

Experiments tested the hypothesis that seeds of *Mitella nuda* are dispersed by the impact of rain on open seed-bearing capsules. Shielding plants from rainfall for a month did not significantly reduce seed dispersal. Reduction of surface wind and exclusion of large animal vectors did not decrease the number dispersed. Results from the field test were reinforced by discovering in the laboratory that simulated raindrops falling on open capsules from a height of 3½ ft. could not cause dispersal. Several hypothetical mechanisms are offered as alternative to the idea that the seeds are dispersed by rainfall. The implications of the results in terms of the evolutionary relationship between *M. nuda* and *M. diphylla* (a species considered to use a splash-cup mechanism) and an apparent adaptive shift within the genus are discussed.

I would like to express appreciation to Dr. Conrad Istock, Dr. Edward G. Voss, and Robert J. Ambrose for invaluable advice and assistance and to the University of Michigan Biological Station for providing facilities and equipment.

LITERATURE CITED

- Martin, G. W. 1927. Basidia and spores of the Nidulariaceae. *Mycologia* 19:239-247.
Pijl, L. van der. 1969. Principles of Dispersal in Higher Plants. Springer-Verlag. Berlin. 154 pp.
Savile, D. B. O. 1953. Splash-cup dispersal mechanism in *Chrysosplenium* and *Mitella*. *Science* 117:250-251.
Stebbins, G. L. 1971. Adaptive radiation of reproductive characteristics in angiosperms II. Seeds and seedlings. *Ann. Review Ecol. Syst.* 2:237-260.

REVIEWS

HOW TO KNOW THE FERNS AND FERN ALLIES. By John T. Mickel. Wm. C. Brown Co., Dubuque, Iowa. 1979. 229 pp. \$6.95 (wire).

This latest number in the well known Jaques Pictured Key Nature Series will surely prove to be one of the best. Here at last (for a bargain price) is a thoroughly up to date assemblage of the rapidly growing body of knowledge about our North American pteridophyte species (but without excessive "splitting"). It covers all of the nearly 400 species occurring north of Mexico, though not all are included in the keys, illustrations, and maps; some (e. g. *Lycopodium dendroideum*, *Selaginella eclipes*, *Botrychium ternatum*) are merely mentioned, with distinguishing characters, by their closest relative. The work is designed for use with no more than a hand-lens (except for *Isoetes*); the illustrations (by Edgar M. Paulton) are lifelike and for the most part should be very helpful.

Following a key to genera, the treatments of all genera are in a single alphabetical sequence and no families are mentioned. A handy checklist at the end is likewise strictly alphabetical (and omits authorities for the binomials, a feature that many namers and labelers would have found useful.) Just when the United States is switching, however reluctantly, to the metric system it seems retrograde for a new scientific book not to use metric measurements (except for spores). And in what is clearly designed to be a compact field manual, it seems absurd to write out in full all measurements ("four hundred fifty to six hundred fifty microns diameter"; "fifteen to thirty inches long, one and one-half to two and one-half inches wide"). There is a bibliography of state and regional manuals (states alphabetical except for Mississippi and Wisconsin) but no other list of references on particular groups or recently recognized taxa.

The tiny distribution maps (which cut off all of Alaska as well as most of Canada and Mexico) show ranges only in a very general way, the limits often as much as several hundred miles off. Locally, for example, *Phyllitis* (the endangered "Hart's Tongue" of the eastern Upper Peninsula) is mapped throughout the Upper Peninsula (though not at all in Tennessee, where it is said also to occur); *Polystichum braunii* and *P. lonchitis* are mapped halfway into the Lower Peninsula; *Asplenium viride* is not shown south to Michigan or the Bruce Peninsula at all, and *Dryopteris celsa* is nowhere near Michigan; *Cryptogramma acrostichoides* is shown throughout the Upper Peninsula (though known only from Isle Royale) and Minnesota (though not reported from even a single location until 1978).

—E. G. Voss

PUBLICATIONS OF INTEREST

ROOT PARASITES OF SOUTHERN FORESTS. By Lytton J. Musselman & William F. Mann, Jr. U. S. Department of Agriculture Forest Service General Technical Report SO-20. 1978. 76 pp. This attractive bulletin includes excellent color photos for 29 species (often showing foliage, flower, and fruit), a key to all genera, and a checklist citing additional species as well. The brief notes say relatively little regarding life history and host attachments. "Very little" may indeed be known of the life history of *Conopholis*, as stated, but more could have been said if the references in Haynes' 1971 monograph of the genus had been utilized. Foresters' lag in botanical matters is well illustrated by the opening sentence of the foreword: "Root parasitic plants were virtually unknown to southern foresters until 1969 . . ."; in a region where *Epifagus*, *Orobanche*, *Conopholis*, *Comandra*, *Aureolaria*, and so many other genera occur, this is an incredible admission! Single copies of this publication are available from the Southern Forest Experiment Station, USDA, Room T-10210, U. S. Postal Service Bldg., 701 Loyola Ave., New Orleans, Louisiana 70113.

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**HALOPHYTES ALONG A MICHIGAN ROADSIDE WITH
COMMENTS ON THE OCCURRENCE OF HALOPHYTES
IN MICHIGAN,**

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The occurrence in any region of species of different habitats and geographical affinities than are usual for the area has always been a matter of great interest to phytogeographers. While in many cases the exact origins and times of migration are lost in antiquity, a few occurrences are susceptible of more exact documentation. One particular phenomenon in Michigan that is apparently still ongoing is the movement of halophytic species into the state.

In 1978 I discovered a site of special interest in Wayne county in the median of Interstate Highway 94, about 5 km (ca 3 mi) northeast of Romulus, near the Merriman Road interchange. There, a remarkable association of halophytes and rare weeds shares the ground with more common roadside species. Along this stretch of road the median is about 30 m wide with gently sloping sides of gravel built up at the edge of the highway lanes and a wide flat bottom wet in spring. The length of roadside examined was about 4 km but not all of this length was occupied by halophyte communities. The area examined for halophytes was thus about 12 hectares.

Halophytes occurred only on the lower parts of the slopes and in the depressions. The areas dominated by halophytes were always in the low, flat bottom of the median. These two facts, as well as the seasonally moist nature of the site and the poor drainage in the median, indicate that the low flat bottom acts as an evaporating pan concentrating salt from spring meltwater of salt-laden snow (as evidenced also by a faint whitish crust of salt seen on the soil surface in some areas). Soil pH varied from 7.8 to 8.3 and exchangeable sodium varied from 567 to 2815 mg/kg in the upper few cm of soil. The combination of features here described is certainly not found along all roadsides; thus, not all roads that are salted during winter will have conditions suitable for halophytes.

The plant communities along the roadsides are undergoing active change. When the road was first built the median was certainly not saline. As the salinity increased with time, species with lower salt tolerance were eliminated and tolerant species remained. Also, variations in soil drainage and minor topography are undoubtedly reflected in variation in soil salt

levels. Thus, the vegetation of this median is a rapidly changing mosaic of variably salt tolerant species. Added to these changes are additional halophytic species that are clearly new immigrants. These species are the most interesting phytogeographically.

Of 122 species of vascular plants recorded in the median, about 24 species or nearly 20% of the flora can be regarded as halophytes or at least species known to be highly salt tolerant (Ungar, 1974; Duncan, 1974; Catling & McKay, 1979). This, however, does not present a true picture of the importance of the halophytes, as many of the 122 species were occasional weeds of the gravel road shoulder and elevated sides of the medium. In the lower part of the medium, halophytes were of great importance.

Of the 24 halophytes noted, 12 species are highly salt tolerant but also occur frequently in a variety of non-saline weedy habitats. These widespread species, more or less frequent in Michigan, are listed in Table 1. Another group of 12 species appearing to be essentially restricted (at least in this region) to sites of high salinity are listed in Table 2 according to geographic relationships. The species listed in Tables 1 and 2 combine to dominate large areas of the median. They usually do not grow intermixed but form large colonies or clonal patches with very few individuals of other species. Large round clones of *Carex praegracilis* and *Muhlenbergia asperifolia* cover substantial areas, and colonies of *Spergularia marina*, *Puccinellia distans*, *Atriplex patula*, *Aster brachyactis*, *Hordeum jubatum*, and *Suaeda calceoliformis* cover much of the lowest parts of the median in certain areas.

In botanical collecting, the recent immigration of halophytes into Michigan has been overlooked. This is clearly evident from the fact that along this short stretch of road were found six species apparently new to the flora of Michigan: *Suaeda calceoliformis*, *Solidago sempervirens*, *Muhlenbergia asperifolia*, *Poa glaucifolia*, *Spergularia marina*, and *Centaureum pulchellum*. These are primarily halophytes. A number of rare and infrequently collected species also noted at the site are listed in Table 3; this list also includes a number of halophytes. (Specimens supporting plants reported here are deposited at MICH with smaller sets at MSC, WAT, LKHD, TRT and GH.)

The occurrence of halophytes in Michigan is a complex phenomenon involving species of varied affinity. It is also clear, judging by the number

TABLE 1. Widespread salt tolerant species at Merriman Road site.

<i>Puccinellia distans</i>	<i>Polygonum aviculare</i>
<i>Phragmites australis</i>	<i>Chenopodium glaucum</i>
<i>Hordeum jubatum</i>	<i>Kochia scoparia</i>
<i>Spartina pectinata</i>	<i>Atriplex hastata</i>
<i>Scirpus americanus</i>	<i>Atriplex patula</i>
<i>Juncus balticus</i>	<i>Aster brachyactis</i>

TABLE 2. Rare halophytes at Merriman Road site.

EASTERN SPECIES	WESTERN SPECIES	EUROPEAN SPECIES
<i>Spartina patens</i>	<i>Poa glaucifolia</i>	<i>Crypsis</i> (<i>Heleochloa</i>) <i>schoenoides</i>
** <i>Spergularia marina</i>	<i>Muhlenbergia asperifolia</i>	<i>Spergularia media</i>
<i>Solidago sempervirens</i>	<i>Diplachne acuminata</i>	<i>Centaureum pulchellum</i>
<i>Aster subulatus</i>	<i>Carex praegracilis</i>	
	* <i>Suaeda calceoliformis</i>	

**Suaeda depressa* Auct., non (Pursh) S. Watson (McNeill, Basset, and Crompton, 1977).

**This species also has a wide range in western North America but its relatively greater abundance inland toward the east indicates that plants at this site may be of eastern origin.

TABLE 3. Rare or infrequently collected species for Michigan at Merriman Road Site.

<i>Sporobolus asper</i>	<i>Plantago arenaria</i>
<i>Crypsis</i> (<i>Heleochloa</i>) <i>schoenoides</i>	<i>Dipsacus laciniatus</i>
<i>Diplachne acuminata</i>	<i>Helianthus petiolaris</i>
<i>Spartina patens</i>	<i>Bidens aristosus</i>
<i>Setaria faberi</i>	<i>Aster subulatus</i>
<i>Carex praegracilis</i>	<i>Aster brachyactis</i>
<i>Spergularia media</i>	<i>Lactuca saligna</i>
<i>Anagallis arvensis</i>	

of halophytes newly reported from Michigan that movement of species into the state is an ongoing event. Nevertheless, Michigan has long been known for the inland occurrence of certain salt marsh species from the East Coast of North America. Fernald (1950) specifically attributed to Michigan *Spartina patens*, *Salicornia europaea*, *Pluchea purpurascens*, and *Aster subulatus*. These were also species reported by Farwell (1916) and Brown (1918) in saline areas on the outskirts of Detroit.

It has been tentatively thought that these species may have been native in salt marshes in Michigan. Brown (1918), discussing salt marsh species occurring around a brine well at Ecorse, speculated that the plants may have been native around a pre-existing salt spring and that the drilling of the well "may have preserved this association of salt plants which was subsequently extended by overflow from the well." Since so many halophytes were recorded at the recently discovered roadside site and there was the possibility that at least some species may have spread from nearby native colonies, if these indeed existed, it was thought of value to examine this problem in more detail. A few lines of evidence can be used to support the occurrences of salt marsh species in Michigan as native: (1) the existence of natural salt springs in Michigan is well known (Catling & McKay, 1979). (2) At least one salt marsh species, *Scirpus olneyi*, was collected in brackish areas associated with salt springs as long

ago as 1837 during the first Survey of Michigan (McVaugh, 1970; Voss, 1972). *Eleocharis parvula*, another coastal halophyte, was collected in brackish areas in Michigan as early as 1875. (3) A number of species, including the four listed above as mentioned by Fernald (1950), occur consistently in the same regions of New York and Michigan, forming an apparently natural pattern.

Nevertheless, more detailed investigations indicate that the bulk of evidence must be interpreted differently. Strong arguments are available to show that, at least in Michigan, halophytes, with the probable exception of *Scirpus olneyi* and *Eleocharis parvula*, were not originally native.

On this roadside site, all the species have certainly migrated to the site since construction of the highway about 20 years ago. The round clones of some species, noted earlier, is indicative of recent establishment. Also, as noted before, none of the halophytes at this site were found by the first survey. In fact, none were known from Michigan before 1910. Some very conspicuous or showy species, such as *Muhlenbergia asperifolia* and *Solidago sempervirens*, are reported as new to the state in this paper. In the Windsor, Ontario, vicinity, where many halophytes now occur, almost all records are recent (Catling & McKay, 1979; Catling, Reznicek & Riley, 1977).

Another point worth noting is that stations beyond the main range of the species are generally in weedy sites. The first Michigan records of *Spartina patens* and *Spergularia media*, for example, were not from salt springs but from a railway yard (Port Huron, St. Clair Co., Dodge in 1910, MSC). Some species are, in fact, very aggressive and are becoming abundant in such sites. *Muhlenbergia asperifolia*, apparently first found in Chicago in 1953, is now a common weed there (Swink, 1974).

The most important evidence pointing to the introduced nature of these species is their distributional history. Two species, representing two of the classes of halophytes given in Table 2 (East Coast salt marsh and Great Plains species), are mapped in Figs. 1 and 2. The North American distributions of *Muhlenbergia asperifolia*, a very widespread western species, is shown in Fig. 1. The eastern localities, denoted by different symbols, are clearly evident from the map and some notable features concerning them can be pointed out: The earliest recorded sites in the east are generally nearest the native range of the species; the first apparently was in 1912 along a railroad near Elgin, Illinois (Sherff, 1912). The eastward spread of this species has been relatively recent. Almost all the far eastern localities were discovered after 1940. Now, this species and other western halophytes are prominent along some roadsides and railways (Swink, 1974; Catling, Reznicek & Riley, 1977; Catling & McKay, 1979). The North American distribution of *Spartina patens*, an East Coast salt marsh species, is shown in Fig. 2. Although there are few inland localities, the earliest record, from Onondaga Co., New York, in 1899 (Goodrich, 1912), again is nearest to the species' continuous range. Not much later, in 1910, it was first recorded from Michigan. This

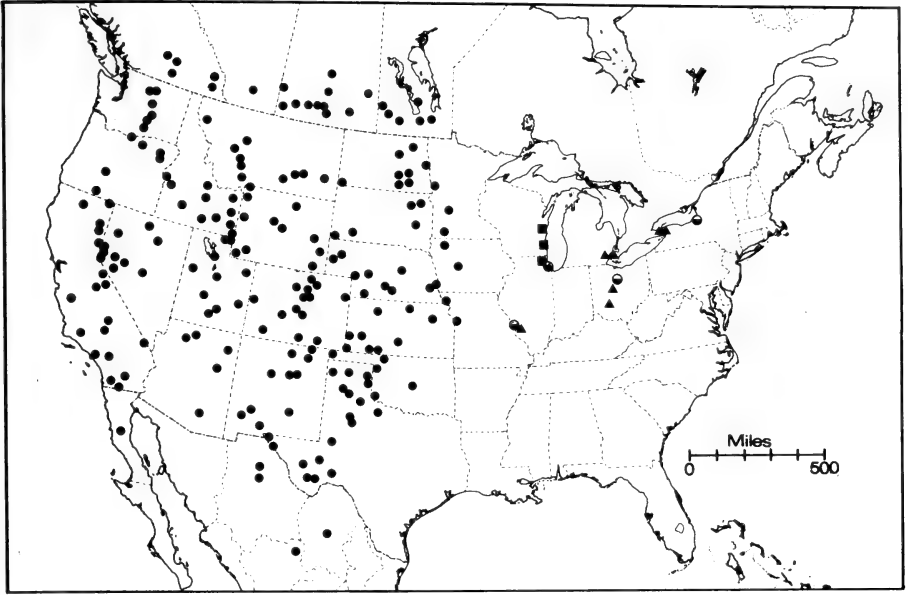


Fig. 1. Distribution of *Muhlenbergia asperifolia* in North America. From herbarium records in GH, NY, MO, MICH, DAO and MSC supplemented by records from OS, NYS, TRT and the herbarium of Niagara University. Explanation of symbols: solid dot—presumed native occurrence; solid square—introduced record, up to 1940; half dot—introduced record, 1941—1960; solid triangle—introduced record, 1961—1978.

species, and some other coastal salt marsh species, such as *Pluchea purpurascens*, *Aster subulatus*, and *Salicornia europaea*, occurred inland much earlier than the western species discussed here.

The distributional history demonstrated by these two species is what one would expect if the plants were migrating into new territory with man's aid. Since settlement and accompanying development of roads and commerce moved from east to west in North America, it is expected that East Coast species could move inland sooner than Great Plains species could move eastward. The rapid recent spread of western halophytes, such as *Carex praegracilis*, *Muhlenbergia asperifolia*, and *Suaeda calceoliformis*, appears related to the extensive, relatively recent use of salt on roads (Mohlenbrock & Evans, 1974; Reznicek, Catling & McKay, 1976). At the time the eastern species first appeared, shortly after the turn of the century, road salting was not practiced although salt was used in railway yards (Catling & McKay, 1979). Thus, the major inland habitats for east coast halophytes would have been salt factories and salt storage areas. The pattern, noted previously, of salt marsh species occurring in the same regions of Michigan and New York can then be explained; as major salt industries were located in these areas. The species probably

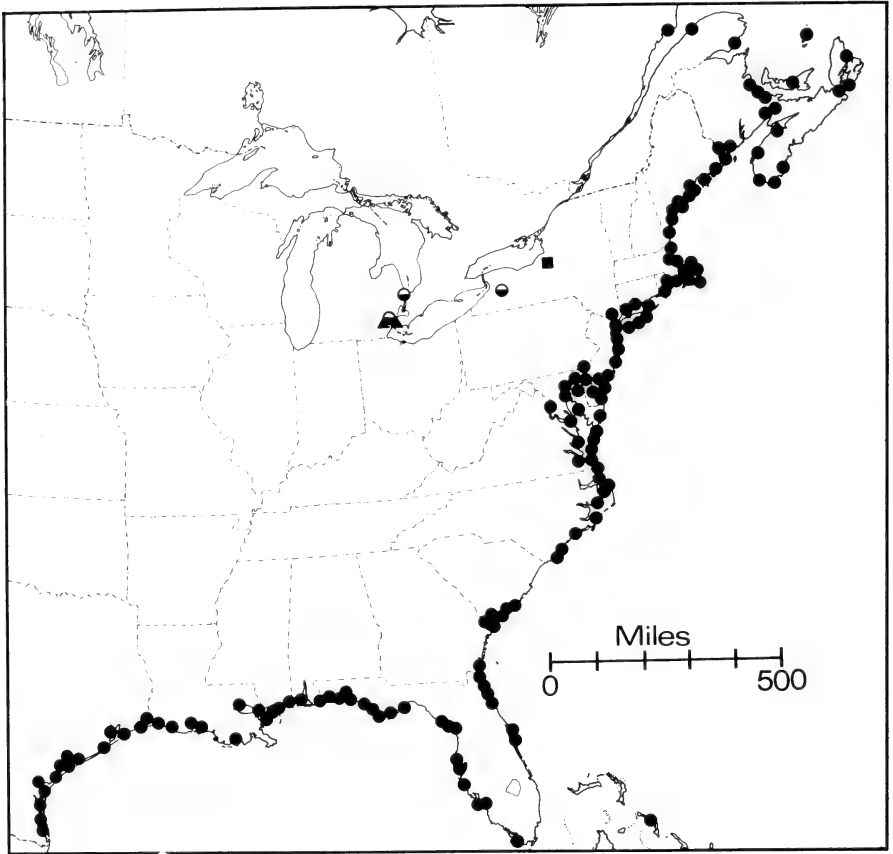


Fig. 2 Distribution of *Spartina patens* in North America. Map adapted from Mobberly (1956) with additional information from Goodrich (1912), Muenscher (1927), Catling, Reznicek and Riley (1977) and specimens in MICH and MSC. Explanation of symbols: solid dot—presumed native occurrence; solid square—introduced record before 1900; half dot—introduced record, 1901—1950; solid triangle—introduced record, 1951—1978.

appeared at these sites when extensive habitats were created long ago by the salt industry much as they appear now in new areas when saline habitats are created (Cusick, 1970; Catling & McKay, 1979).

The fact that the western halophytes appear to spread much more rapidly along roadsides and be more weedy than eastern salt marsh species is somewhat perplexing. A likely hypothesis is that western halophytes are more resistant to the summer drought conditions that prevail along many roadsides.

This remarkable roadside site, with numerous rarely collected species and six species apparently new to Michigan, clearly represents a new botanical phenomenon in the state. The evidently introduced nature of the halophytes at this site and their obvious colonizing ability suggested that these species and at least some other halophytes, sometimes considered at least partly native in Michigan, may in fact be entirely introduced. Analysis of the distributional history of two representative halophytes at various sites supported the hypothesis that the species discussed are introduced into Michigan. It seems clear that the halophytes, both East Coast and Great Plains species, have moved into Michigan in response to local increases in soil salinity as a result of human activity. The halophyte floras of this and other Michigan sites (Farwell, 1916; Brown, 1918) appear to have developed by the gradual accumulation of introduced species of varying affinity and the elimination of the original flora of the site by increasing salt levels. If the practice of road salting continues, these species, and others not yet recorded, will undoubtedly continue to spread and become an important and interesting component of Michigan's flora.

I am most grateful to P. M. Catling and S. M. McKay for enjoyable discussions about inland halophytes and for making available their manuscript (Catling & McKay, 1979) on inland halophytes. R. L. Stuckey, R. S. Mitchell, and Gary Pierce supplied records of *Muhlenbergia asperifolia* for which I am very grateful. Also, I would like to thank E. G. Voss for the use of his extensive files on the occurrence of plants in Michigan and comments on this paper. Thanks are due to C. W. Crompton and C. O. Hopkins for determining specimens of *Suaeda* and Mary Barkworth for examining the specimen of *Poa glaucifolia*. My wife Susan's help in the field was much appreciated.

LITERATURE CITED

- Brown, F. B. H. 1918 ["1917"]. Flora of a Wayne County salt marsh. Ann. Rept. Mich. Acad. Sci. 19:219.
- Catling, P. M. & S. M. McKay. 1979. A review of the occurrence of halophytes in the eastern Great Lakes Region. Manuscript in preparation.
- Catling, P. M., A. A. Reznicek & J. L. Riley. 1977. Some new and interesting grass records from southern Ontario. Can. Field-Nat. 91:350-359.
- Cusick, A. W. 1970. An assemblage of halophytes in northern Ohio. Rhodora 72:285.
- Duncan, W. H. 1974. Vascular halophytes of the Atlantic and Gulf coasts of North America north of Mexico. In R. J. Reimhold & W. H. Queen (Eds.). Ecology of Halophytes. Academic Press, New York. xiv + 605 pp.
- Farwell, O. A. 1916. New ranges for old plants. Rhodora 18:243-244.
- Fernald, M. L. 1950. Gray's Manual of Botany Ed. 8. Am. Book Co., New York. 1xiv + 1632 pp.
- Goodrich, L. L. H. 1912. Flora of Onondaga County as Collected by the Members of the Syracuse Botanical Club. The McDonnell Co., Syracuse. 210 pp.
- McNeill, J., I. J. Bassett & C. W. Crompton. 1977. *Suaeda calceoliformis*, the correct name for *Suaeda depressa* Auct. Rhodora 79:133-138.
- McVaugh, R. 1970. Botanical results of the Michigan Geological Survey under the direction of Douglas Houghton, 1837-1840. Mich. Bot. 9:213-243.

- Mobberly, D. G. 1956. Taxonomy and distribution of the genus *Spartina*. Iowa State Coll. Jour. Sci. 30:471-574.
- Mohlenbrock, R. H. & D. K. Evans. 1974. Illinois field and herbarium studies. *Rhodora* 76:460-470.
- Muenschner, W. C. 1927. *Spartina patens* and other saline plants in the Genesee Valley of western New York. *Rhodora* 29:138-139.
- Reznicek, A. A., P. M. Catling & S. M. McKay. 1976. *Carex praegracilis* W. Boott, recently adventive in southern Ontario. Can. Field-Nat. 90:180-183.
- Sherff, E. E. 1912. Range extensions of *Rhamnus frangula* and *Sporobolus asperifolius*. *Rhodora* 14:227.
- Swink, F. 1974. Plants of the Chicago Region. Ed. 2. Morton Arboretum, Lisle. xxiv + 474 pp.
- Ungar, I. A. 1974. Inland halophytes of the United States. In R. J. Reimhold & W. H. Queen (Eds.). Ecology of Halophytes. Academic Press, New York. xiv + 605 pp.
- Voss, E. G. 1972. Michigan Flora. A Guide to the Identification and Occurrence of the Native and Naturalized Seed-Plants of the State, Part I. Gymnosperms and Monocots. Cranbrook Inst. Sci. Bull. 55. Cranbrook Inst. Sci., Bloomfield Hills, and Univ. of Mich. Herb. xv + 488 pp.

REVIEWS

THE NATURE AND STATUS OF ETHNOBOTANY. Anthropological Papers, Museum of Anthropology, University of Michigan, No. 67. Edited by Richard I. Ford. 1978. 428 pp. \$9.50 (paper).

Dedicated to Volney H. Jones in the 75th year of his active life, this volume contains 16 articles dealing with ethnobotanical topics around the world. M. Jean Black's "Plant Dispersal by Native North Americans in the Canadian Subarctic" [actually southern Boreal Forest] comes as close to the Great Lakes region as any of the papers, but in addition there are warm biographical sketches and a bibliography of Volney Jones, who with his wife Joyce was active in the early years of the Huron Valley Chapter of the Michigan Botanical Club and whose own ethnobotanical field work included experience with the Ottawa and Chippewa Indians of Michigan in the 1930's.

—E. G. Voss

EDIBLE WILD PLANTS OF THE GREAT LAKES REGION. By Ellen Elliott Weatherbee & James Garnett Bruce. 1979. 69 pp. \$4.95 (paper). [Available by mail from the senior author, Box 8253, Ann Arbor, Michigan 48107; add \$.50 postage and \$.20 Michigan sales tax.]

The product of successful adult education classes and much field experience, this attractive little volume includes some general advice and discussions of about 40 species or genera. The photographs were apparently taken especially for this book and show details, habit, and harvest. The text covers not only identification but also gathering and uses, and sometimes nutritive value or a recipe. Although the title correctly suggests usefulness throughout the Great Lakes region, the orientation is clearly toward the southern Lower Peninsula of Michigan, a third of the species not being found farther north (except perhaps very rarely); none found primarily to the north being included; and widespread species sometimes too restricted as to their favored habitat (prolific blueberries "in bogs and acid swamps" would seem to exclude hundreds of acres of productive pine plains). This is a truly original and authentic work and worth adding to one's edible plant library!—E. G. Voss

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**A PROBABLE NEW HYBRID GRAPEFERN, *BOTRYCHUM*
MATRICARIIFOLIUM × *SIMPLEX*, FROM
CENTRAL MICHIGAN**

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The grapefern genus, *Botrychium*, consisting of about 30 species, ranges nearly throughout the world. It is especially well represented in north temperate regions, but many of the species are poorly collected and considered rare mainly because they are inconspicuous. They tend to grow in second-growth grassy and weedy sites that are not attractive to botanists. However, the person who has the interest to explore for these curious little plants is often amply rewarded. For the Lower Peninsula of Michigan, an ideal area for studying them, we now have records for no less than ten species (Hagenah, 1966), some of them remarkably variable in size and leaf shape.

Starting in the 1940's, the late Dale J. Hagenah, together with his wife, Ethelda, made extensive searches for these plants that resulted in unusually complete county distribution maps. By far the most common is the rattlesnake fern, *Botrychium virginianum* (subg. *Japanobotrychium*). In subgenus *Sceptridium* (the evergreen grapeferns), *B. multifidum* is the most frequent species in the northern half of the state, and *B. dissectum* is the most frequent in the southern half. In the typical subgenus *Botrychium* (the moonworts or dwarf grapeferns), the most common species in the state as a whole are *B. matricariifolium*., the daisy-leaf grapefern, and *B. simplex*., the little grapefern or dwarf moonwort; these are often associated with each other in the same communities. The purpose of this paper is to report some apparent hybrids that were discovered in the Lower Peninsula. The plants described here stood out as unusual, even when the notorious variability of the presumed parents was taken into account.

The first specimen in question (Figs. 1, 2) was found in Midland County (in a second-growth field on E side of Jefferson Rd., 0.5 mi. N of Shearer Rd., R2E, T16N, Sect. 15, 3 June 1959, Wagner 8997) growing with abundant plants of *B. matricariifolium* and *B. simplex*. At the time of collection I thought it was the Mangan moonwort, *B. manganense*., well known and common in northern Michigan but rare in central and southern Michigan (Wagner & Lord, 1956; Hagenah, 1966). Later examination, however, showed that the specimen differed from typical *B. manganense*



Fig. 1. Putative hybrid, *Botrychium matricariifolium* \times *simplex*, dried, $\times 0.8$ (Wagner 8997).

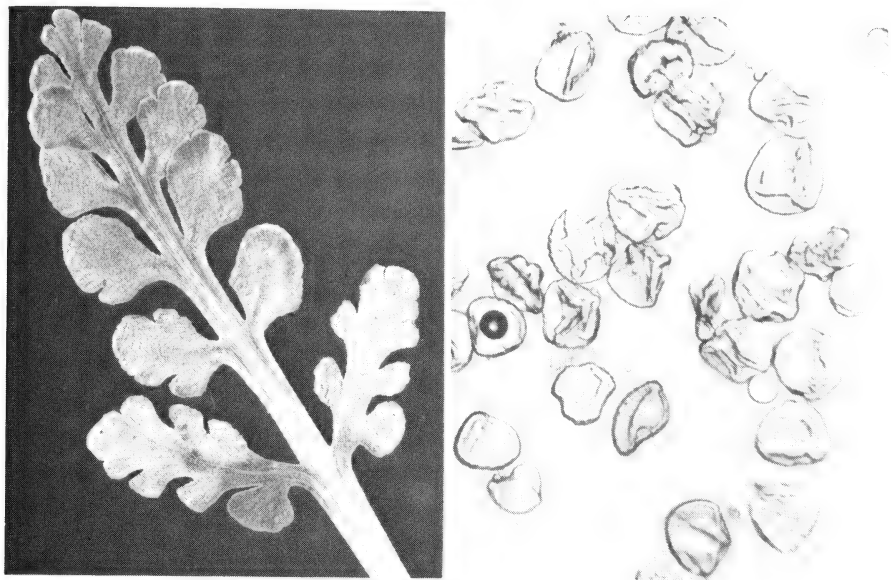


Fig. 2. Putative hybrid, *Botrychium matricariifolium* \times *simplex*, sterile segment, $\times 2.3$. Fig. 3 (right). Abortive spores of putative hybrid (Wagner 8997).

in a number of respects and seemed intermediate between *B. matricariifolium* and *B. simplex* (Fig. 4).

Later I received from the Cranbrook Institute of Science a gift of unmounted specimens collected by Dale Hagenah, and these included a couple of fronds identified by him as *B. minganense* from Arenac County (in clearing on sand ridge between State Rd. and the Detroit & Mackinac R.R., R5E, T18N, Sect. 4, 10 June 1969, Hagenah 6841). These specimens too, when examined critically, turned out not to conform to *B. minganense*, but when I consulted Hagenah's field notebooks I found that he had recorded only *B. matricariifolium* at the locality. I therefore revisited the site on 6 June 1976 to see whether *B. simplex* could also be found there and was successful. Although *B. matricariifolium* is much more numerous, there are some colonies of *B. simplex* (Wagner 76004). Additional plants of the intermediate, however, were not encountered.

Herbarium studies of the three grapefern specimens originally thought to be *B. minganense* revealed immediately that all of them have abortive spores (Fig. 3), a reliable characteristic for recognizing sterile hybrid ferns. Included among the spores are large rounded ones that are approximately spherical and small angular ones that are flattened. It may be speculated that the large spherical ones are undivided spore mother cells that produced spore walls and that the small angular ones are the

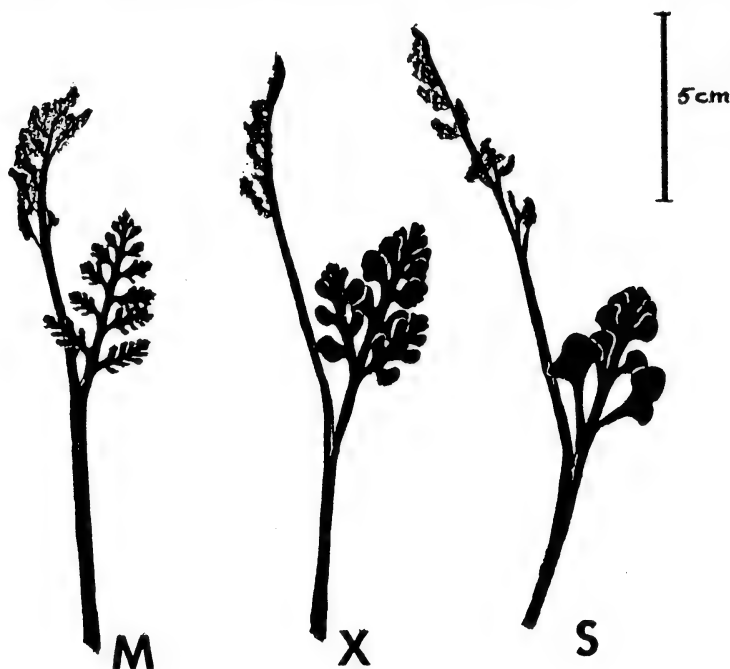


Fig. 4. Silhouettes traced from xerox of dried specimens shown from below to emphasize segment overlap: M, *B. matricariifolium* (Arenac Co., Wagner 76003), X, putative hybrid, large form (same locality, Hagenah 6841); S, *B. simplex* frond of comparable size (Gladwyn Co., Wagner 9019).

products of irregular meiosis—both evidences of faulty sporogenesis resulting from interaction of hybrid genomes.

To characterize the unusual plants, it is best to compare them to *B. matricariifolium*, which is the more common of the putative parents and the one to which the intermediate plants bear the closer resemblance and with which they are the more easily confused. The stalk of the sterile blade in the putative hybrids is well developed, but in *B. matricariifolium* it is short or even absent, so that the sterile blade is subsessile or sessile. The basal sterile pinna pair in the hybrids is two to three times as long as the adjacent pair; in *B. matricariifolium*, the basal pinna pair is only slightly larger on the average. The ultimate segments in the supposed hybrids are coarse, approximately 1.5–2.5 times as wide as the usual ones in *B. matricariifolium*. Some of the ultimate segments, especially the basal ones, tend to be subflabellate, rather than oblong or narrowly deltoid as in *B. matricariifolium*. All of these differences of the hybrids from *B. matricariifolium* appear to show the influence of *B. simplex*. (To compare *B. minganense*, see Wagner & Lord, 1956).

The specimens described here are apparently the first grapeferns reported in which the spores show the abortive condition.

The fact that the hybrids are closer to *B. matricariifolium* than *B. simplex* may be explained by the chromosome relationships. The gametic chromosome number of *B. matricariifolium* is $n = 90$, but that of *B. simplex* is only $n = 45$ (Wagner, 1955). The former would be expected to contribute twice as many genes as the latter, and hybrids should accordingly have lopsided inheritance, closer to the tetraploid than the diploid parent. Hybrids of the triploid constitution (in this case, $90 + 45$) always show irregular meiosis and correspondingly irregular sporogenesis leading to abortive spores.

In general, interspecific hybridization has played a powerful role in creating distinctive taxa among pteridophytes, but so far we have little evidence of its influence in the Ophioglossaceae.* The only other probable hybrids in North American botrychiums are fertile and have normal spores. One is *B. boreale* Milde of the Northwest, a tetraploid with $n = 90$ chromosomes, which is intermediate between *B. lanceolatum* (Gmel.) Ångstr. ($n = 45$) and *B. lunaria* (L.) Sw. ($n = 45$) (Wagner in Fabbri, 1963, and unpublished). The other is *B. alabamense* Maxon of the Southeast (also with $n = 90$), which is morphologically between *B. lunarioides* (Mx.) Sw. ($n = 45$) and *B. bitermatum* (Sav.) Underw. ($n = 45$) (Wagner, 1962, 1968). In both cases, the intermediates are evidently allotetraploids in which the original sterile hybrids (formula: AB, with irregular or no chromosome pairing in meiosis) doubled their chromosome complements to become fertile (formula: AABB, with normal pairing). The presumed hybrid described here is, to the best of my knowledge, the first sterile hybrid to be reported and is predicted to have the cytogenetic formula of A^1A^2B (letting $A^1A^1A^2A^2 = B$. *matricariifolium* and $BB = B$. *simplex*).

The unusual grapeferns described here very likely arose as spontaneous crosses between the fertile species growing with them. More examples should be sought wherever we encounter *B. matricariifolium* and *B. simplex* growing together, not only in Michigan but other areas (e.g., Vermont, New Hampshire, and Bruce Co., Ontario) where these species are common. The intermediates may be more frequent than we now realize, but because of the subtlety of their characters may be difficult to spot or to distinguish from *B. matricariifolium*.

Unusual specimens of grapeferns, *Botrychium*, casually resembling *B. minganense* Vict., appear to be hybrids between *B. matricariifolium* A. Br. and *B. simplex* E. Hitchc. Collections were made in Midland and Arenac Counties, Michigan, in localities where both of the putative parents occur. That the specimens in question are actually hybrids is supported by association with the parents, intermediacy between them, and strongly irregular spores. The specimens lie closer morphologically to *B. matricariifolium* than to *B. simplex*. This fits with the fact that the former is a tetraploid, the latter a diploid.

*Sahashi (Jour. Jap. Bot. 54, Aug. 1979) has reported a sterile hybrid in the Sceptridium group of grapeferns from the Izu Islands.

I am indebted to Robert F. Blasdell, Joseph M. Beitel, Ethelda Hagenah, and Florence S. Wagner for their help.

LITERATURE CITED

- Fabbri, F. 1963. Primo supplemento alle Tavole Cromosomiche delle Pteridophyta die Alberto Chiarugi. *Caryologia* 16:237-335.
- Hagenah, D. J. 1966. Notes on Michigan pteridophytes, II. Distribution of the Ophioglossaceae. *Amer. Fern Jour.* 56(4):150-163.
- Wagner, W. H., Jr., 1955. Cytotaxonomic observations on North American ferns. *Rhodora* 57:219-240.
- . 1962. The endemic botrychiums of the southeastern United States. (Abstract). *ASB (Assoc. Southern Biologists) Bull.* 9:40.
- . 1968. Hybridization, taxonomy, and evolution. pp. 113-138 in Heywood, V. H., *Modern Methods in Plant Taxonomy*. Academic Press, London & New York.
- & Lois P. Lord. 1956. The morphological and cytological distinctness of *Botrychium minganense* and *B. lunaria* in Michigan. *Bull. Torrey Bot. Club* 83:261-281.

REVIEW

PLANTS OF THE CHICAGO REGION. A Checklist of the Vascular Flora of the Chicago Region, with Keys; Notes on Local Distribution, Ecology, and Taxonomy; and a System for Evaluation of Plant Communities. Revised & Expanded Ed. By Floyd Swink & Gerould Wilhelm. Morton Arboretum, Lisle, Illinois 60532. 1979. lxxiii + 922 pp. \$14.00 (cloth) [plus \$1.00 postage & handling].

Only five years ago the second edition of this fine work was reviewed here, and that five years after the first edition. Already we have a greatly expanded third edition, enlarged not so much by the addition of about 25 species as by the inclusion of keys. These look both original and useful, though perhaps using too freely the uninformative "Not as above." There is a key to families at the beginning; keys to genera within a family and to species within a genus appear with the entries at these levels, which as before are in a single alphabetical list constituting the body of the text. One innovation in this edition is the use of italic type (in keys, in primary listings, and in the lists of associates) for names of species not considered indigenous in the area. Another is the use of three different symbols on the distribution maps (now provided for all species), although it is still not possible to determine which county records are supported by herbarium specimens examined by the authors. Over two-thirds of the solid circles are said to be based on specimens; open circles are based only on sight records by the authors; and triangles are based only on reliable literature. These and other helpful matters are fully explained in the expanded introduction. At the end of the book are an index to names (mostly synonyms of all sorts) not in the alphabetical listing, a list of families and genera in the sequence of *Gray's Manual* ed. 8, "A method for environmental assessment of open land," a glossary, and a bibliography.

The nomenclaturally alert will regret the continued use of undesigned trinomials, even attributed to other authors, although the introduction assures us that all are to be considered varieties. What then does one do when an author is said to call our plant [he did not] "*R. palustris glabra fernaldiana*"? Nomenclature otherwise, for consistency with previous editions and with the extensive lists of associates, almost entirely follows *Gray's Manual*, although attention is called to various opinions on alternatives; the concept of "legitimate" names is not always that of the Code of Nomenclature.

The Chicago Region includes 22 counties (Berrien the only Michigan one), but this very useful and carefully prepared volume will be of considerable value throughout a far wider area.

—E. G. Voss

A HYBRIDIZING *VERBASCUM* POPULATION IN MICHIGAN

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For students of the flora of the Upper Great Lakes, the study of weeds becomes increasingly meaningful, for their potential economic impact and for botanical reasons as well. In the eastern United States and Canada no less than one out of five higher plant species that occur spontaneously have been introduced, mainly from Eurasia (Fernald, 1950, p. 1xiv). Many of these aliens have become weeds in the full sense of the word—they are abundant, occur in disturbed sites, and are unwanted.

Members of the Eurasian genus *Verbascum* are frequent weeds in eastern North America. The Common Mullein, *V. thapsus*, tends to be conspicuous for its tendency to grow in mowed areas along highways. The tall and yellow-flowered spikes are visible throughout the Upper Great Lakes region, where the plant develops local populations, sometimes including thousands of individuals. Much less successful an invader is the related Clasping-leaved Mullein, *V. phlomoides*. Occurrences are widely scattered, and the plant is generally considered rare. However, like the Common Mullein, it has the ability to generate large populations locally, and it tends to grow in the same places. As a result of finding mixed populations along highways in southern Michigan, we were especially interested to find out what happens when they are in contact, because Ferguson (1972) noted that sterile hybrids, intermediate between the parents in most features, are often found where *Verbascum* species grow together in Europe. The name *V. ×kernerii* Fritsch has been used for the hybrid of *V. thapsus* and *V. phlomoides*.

An excellent opportunity to observe these species in the field was made possible by their discovery along a major highway about five miles west of Ann Arbor. The population we selected to study contained both *V. thapsus* and *V. phlomoides*, as well as their hybrid, *V. ×kernerii*. Their occurrence under the same site conditions made it possible to compare the taxa character-by-character and thus clarify their relationships.

Habitat and Occurrence. The study area is included in Scio Township, Washtenaw County. The populations are scattered along the divided highway, Interstate 94; the plants are found in grassy areas on the north and south sides of the east-west thoroughfare, as well as in the median. Some populations are pure *V. thapsus* and some pure *V. phlomoides*. Others are mixed, and the one we chose for our studies is an extensive population approximately 50–70 m in diameter at the interchange of I-94 and Baker Road, SW corner of sect. 17 (T2S, R4E). The total number of

plants of *Verbascum* was estimated to be between 500 and 600. Over half were *V. thapsus*, and over one-third *V. phlomoides*. Approximately one plant in ten proved to be the hybrid.

At first sight the area in which the mulleins grew appeared to be a field of tall grasses. Indeed the habitat was dominated by grass, *Agropyron repens*, *Bromus inermis*, *Lolium perenne*, and *Phleum pratense*, all weedy plants probably introduced from Eurasia. As we inspected the site in more detail, however, we encountered sporadic occurrences of various herbaceous and woody plants. The numbers of native species compared to introduced was roughly one to one. Of the former there was 18, of the latter 15.

NATIVE—*Acer negundo*, *Ambrosia artemisiifolia*, *Asclepias syriaca*, *Conyza canadensis*, *Desmodium* sp., *Equisetum* \times *ferrissii*, *Euphorbia corollata*, *Lactuca canadensis*, *Lespedeza* cf. *capitata*, *Oenothera biennis*, *Polygonatum canaliculatum*, *Rubus* cf. *flagellaris*, *Smilax herbacea*, *Solidago* sp., *Toxicodendron radicans*, *Tradescantia* sp., *Ulmus americana* (young sapling), *Vitis riparia* (young).

INTRODUCED—*Achillaea millefolium*, *Centaurea maculosa*, *Cirsium arvense*, *Daucus carota*, *Hypericum perforatum*, *Lepidium campestre*, *Linaria vulgaris*, *Lychnis alba*, *Nepeta cataria*, *Plantago lanceolata*, *Potentilla recta*, *Rumex acetosella*, *Saponaria officinalis*, *Tragopogon dubius*, *Trifolium arvense*.

We divided the area of the mixed population, which was approximately circular, into two roughly equal parts, and counted all the *Verbascum* plants in one of them. The total was 261 plants, of which 141 were *V. thapsus*, 93 *V. phlomoides*, and 27 *V. \times kernerii*. The height distribution of this sample is shown in the histogram in Fig. 1.

Comparison of Species. The more prominent differences between *V. thapsus* and *V. phlomoides* are enumerated in the familiar manuals for the flora of eastern North America. A more detailed comparison based upon our studies is given in Table 1. The differences are best shown in the largest individuals which are so distinctive that they may be recognized even from a passing car. By September the fruiting plants of *V. thapsus* are practically all dead and brown (unless they had been mowed and resumed growth); most of the plants of *V. phlomoides* are then at least partially green, and many are still flowering.

Although when growing under the same conditions, the two species tend to average approximately the same height, *V. phlomoides* has a denser appearance of the foliage due to the shorter intervals between leaves. The absence of branches of the inflorescence in most large individuals of *V. thapsus* contrasts with their presence in *V. phlomoides*. As shown in Table 2, however, the majority of plants of the latter that are below 150 cm. tall lack inflorescence branches, and from a distance such plants might be confused with *V. thapsus*.

The two best characters for separating all plants of the two species, including the small ones, are the extent of vertical wings on the internodes (complete in *V. thapsus*, running from leaf to leaf, vs. absent or only slightly formed in *V. phlomoides*) and the arrangement of the flowers (so

TABLE 1. Comparison of two mulleins and their hybrid.

	<i>V. thapsus</i>	<i>V. ×kernerii</i>	<i>V. phlomoides</i>
Time of death	August	August-September	September
Height of plant (m)	1.23(0.64-2.19)	1.94(1.02-3.02)	1.39(0.70-2.15)
Internodes	Long	Intermediate	Close
Leaf shape	Elliptic to obovate	Variable, intermediate	Lanceolate to ovate-cordate.
Extent of wings on internodes	Leaf to leaf, straight to crinkled	Leaf to leaf, or only part way, crinkled	Only slightly decurrent
Blade margins	Entire to shallowly crenate (scallops less than 1 mm tall)	Crenate (scallops ca. 1 mm tall)	Crenate to dentate (scallops 1-3 mm tall)
Spike branches	Usually absent, rarely 1 or more in very tall individuals	Present in ca. one-third of plants	Present in ca. one-third of plants
Flower arrangement	Densely compact, nodes less than 5 mm; axis not visible except near base	More open, nodes 7-15 mm apart; axis partially visible	Spread out, nodes 10-30 mm apart; axis clearly exposed
Flower length × width (mm.)	10-15 × 11-15	20-27 × 21-27	24-34 × 22-34
Capsules	Enlarged, seeds fully developed	Only partially enlarged, seeds abortive	Enlarged, seeds fully developed

TABLE 2. Development of Lateral Spikes. Upper figures in parentheses = percentage of spikes with laterals in each size class. Lower figures = average number of lateral spikes per plant in size class.

Height in cm	50	100	150	200	250	300
THAPSUS	(0%)	(1%)	(12%)	—	—	—
no. = 141	0	.01	.12	—	—	—
×KERNERI	—	—	(12%)	(50%)	(100%)	—
no. = 59*	—	—	.1	.9	3.4	—
PHLOMOIDES	(5%)	(18%)	(53%)	—	—	—
no. = 124*	.1	.7	2.3	—	—	—

*Additional samples were taken from other half of study population.

crowded that the inflorescence axis is not visible vs. so remote that large sectors of inflorescence axis are exposed).

The first year over-wintering rosettes of the two species show differences, but unfortunately the hybrid rosettes are confusing and make it difficult to be certain about any individual specimen. R. B. Cranfill

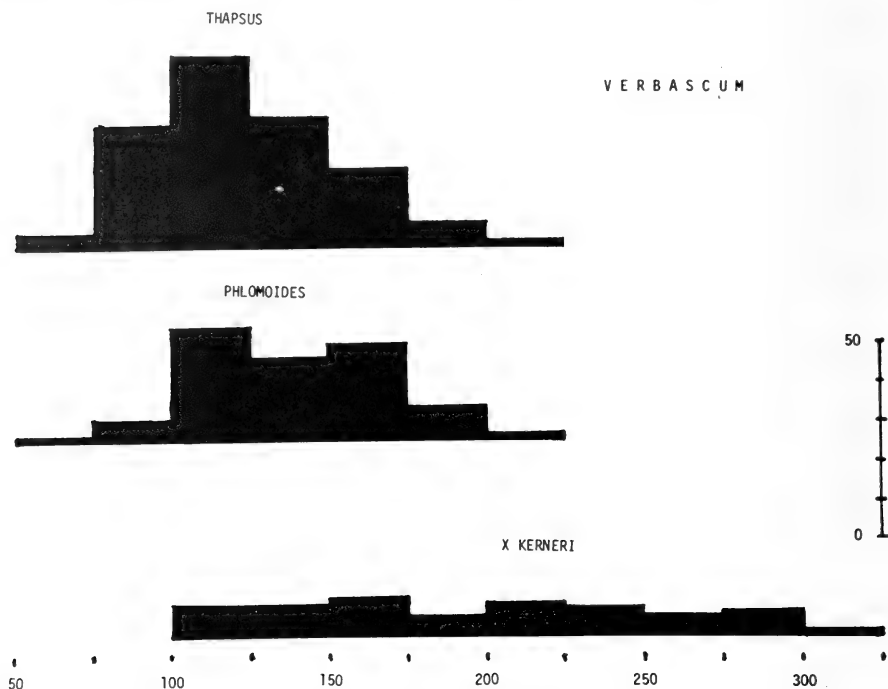


Fig. 1. Histogram showing number of individuals (vertical scale) per size class (horizontal scale, in centimeters).

determined by comparison with mature fertile plants that there are two extreme types. One, belonging to the *V. thapsus* end of the spectrum, shows rosettes with oblanceolate leaves that are blunt at the apex and shallowly crenulate at the margins. The veins are superficial and the tertiary ones difficult to see. The petiole is much flattened in the plane of the blade. The other extreme, *V. phlomoides*, has lanceolate to suboblanceolate leaves that are acute at the apex and have markedly dentate-crenulate margins. The veins are conspicuously embossed, and the tertiary ones are distinct. The petiole is much less flattened in the plane of the blade. The *V. thapsus* rosette is more tomentose than that of *V. phlomoides*; in the latter, the tomentum becomes reduced, especially between the veins.

Characteristics of V. × kernerii. The hybrid shows practically all characters to be intermediate between the parents (Table 1). Especially valuable morphological characters for recognition purposes are the length of internodal wings (Fig. 2) which varies greatly but usually extends only part way (not leaf to leaf); the spike branches which also vary considerably but average in large individuals from 2 to 3 (rather than 0 to 1 as in *V. thapsus*, or 4 to 6 as in *V. phlomoides*); and the distribution of flowers on



Fig. 2. Leaf decurrence of *V. thapsus* (upper left), *V. phlomoides* (upper right), and *V. kernerii* (lower left and lower right).

the inflorescence (Fig. 3), which are only partially contiguous (not completely compacted or widely separated).

The capsules of *V. ×kernerii* are immediately separable (Fig. 3) from those of its parents in late August and September because they fail to open properly and contain only minute, abortive seeds. They apparently expand after pollination as if they would develop normally, and the ephemeral flower parts fall off; however, they never reach the full size of the parental fruits and never (so far as we could determine) form normal seeds.

Another noteworthy feature of the hybrid is its very large size (Fig. 1). Without careful study, large individuals of *V. ×kernerii* may be confused with *V. phlomoides* because they have unusually large and numerous lateral branches on the inflorescence (Fig. 4). However, comparably sized large individuals of *V. ×kernerii* and *V. phlomoides* tend to differ in the number and size of the laterals. Indeed, the main inflorescence axis of the former is extremely tall and whip-like, as a rule, and many plants can be recognized by this feature alone. So long does this whip appear that we wondered whether the large size, which we took to be evidence of a type of hybrid vigor, might not be due simply to exaggerated growth of the main inflorescence.

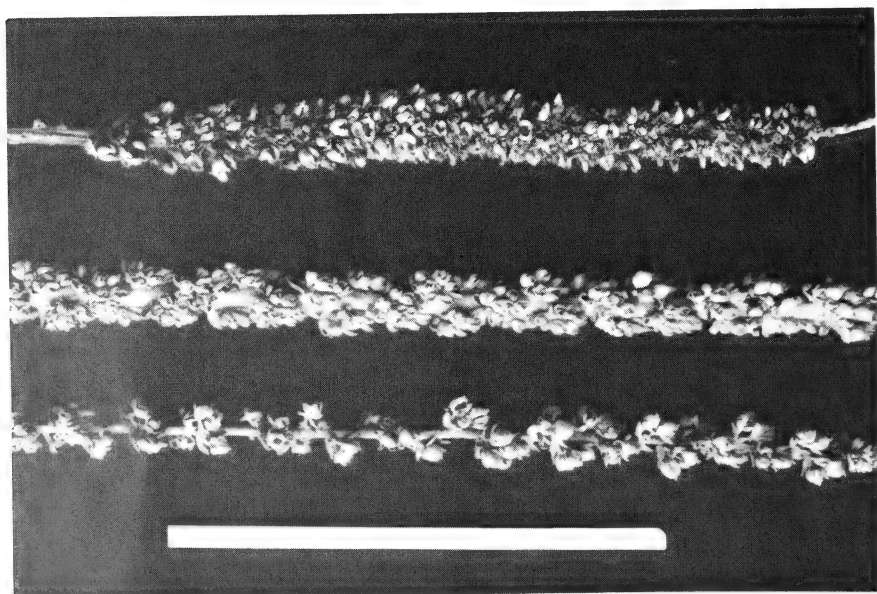


Fig. 3 Comparison of inflorescences of *Verbascum thapsus* (top), *V. ×kernerii* (center), and *V. phlomoides* (bottom). White strip = 15 cm.



Fig. 4. Comparison of the habit of *Verbascum thapsus* (left), *V. ×kernerii phlomoides*-like form (center), and *V. phlomoides* (right).

We hypothesized that the hybrid might allocate the same relative amount of tissue to the inflorescence as *V. phlomoides* and that the apparent gigantism of the inflorescence might be a result of the hybrid having fewer and/or smaller lateral branches and putting the extra inflorescence tissue into the whip. To investigate these questions we took data on 25 plants each of the hybrid and *V. phlomoides*, collecting only individuals that exceeded 175 cm. in height, that is, the ones that typically showed lateral branching. The data are summarized in Table 3. Both parametric (student t test, F test) and nonparametric (Mann-Whitney U test) tests were used to assess the statistical significance of the observed

TABLE 3. Comparison of means of inflorescence characters of two mulleins.

Character	<i>V. ×kernerii</i>	<i>V. phlomoides</i>
**Whip length (cm)	126.4	102.7
**Number of lateral branches	2.4	5.1
Length of laterals (cm)	26.1	29.9
*Total inflorescence length (cm)	194.8	262.4
Whip length/total plant height	.549	.551

*Difference statistically significant at the .05 level.

**Difference statistically significant at the .01 level.

differences in means. The Mann-Whitney U test was used in place of the t test when the variances of the two populations were not equal.

As can be seen from the table, the hybrid does indeed have a significantly longer whip than does *V. phlomoides*. However, the observed difference can be attributed to the fact that the hybrid is significantly taller than *V. phlomoides*, as there is no significant difference in the ratio of whip length to plant height between the two taxa. Thus, the gigantism of the hybrid cannot be explained by a disproportionate increase in the length of the main inflorescence.

The number of lateral branches on the inflorescence, but not their average length, takes on an intermediate value in the hybrid, with *V. thapsus* possessing none (rarely 1 or 2), *V. ×kernerii* 2.4, on the average, and *V. phlomoides* 5.8. The average length of the lateral branches remains the same between *V. ×kernerii* and *V. phlomoides*, namely 26–30 cm. Thus *V. phlomoides*, in terms of length, has more inflorescence tissue in its lateral branches than *V. ×kernerii*, while *V. ×kernerii* has more inflorescence tissue in its main axis. If the total length of the whole inflorescence is calculated by adding the lengths of the lateral branches to the length of the main axis, we discover that *V. phlomoides* has more total inflorescence tissue per plant than does *V. ×kernerii*. Thus our original hypothesis concerning the equal investment in inflorescence length by *V. phlomoides* and *V. ×kernerii* is not supported by the data.

DISCUSSION

The hybrid *Verbascum ×kernerii* shows a number of classical hybrid characteristics. Its characters are, for the most part, nicely intermediate between those of its parents, especially with respect to the characters of most value in discriminating the parents, including internodal wings, number of inflorescence branches, and arrangement of flowers and fruits. The hybrid fruits are abortive and the seeds minute and probably all incapable of normal germination, and the stature of the plant considerably exceeds that of its parents, thus illustrating hybrid vigor. Our analysis of

tallness shows that it is due not only to exaggerated growth of the whip-like main inflorescence but also to stature of the plant as a whole.

What is most surprising about the hybrid is its relative abundance. At the locality where we studied the plants in detail, approximately one out of ten plants were hybrids—a proportion far greater than we normally encounter in plant hybrids. At first we thought that we were observing a hybrid swarm, in which hybrids were backcrossing with their parents and that a certain degree of hybrid fertility had been achieved, thus making possible the build-up of the hybrid populations. Not until we began studying the capsules did we realize that there is no evidence of fertility. From what we have seen so far, the hybrids are completely sterile. There is no hybrid swarm and all of the hybrids, therefore, must represent single crossings, each one *de novo*.

Further studies are clearly called for, if we are to understand the unusually large numbers of hybrids. It is interesting that *V. phlomoides* is so local and sporadic in occurrence, and especially so because where it does occur it has the capacity of generating huge populations. A further question pertains to another *Verbascum* and its relationships to the taxa considered here: *Verbascum thapsiforme* Schrad. (syn. *V. densiflorum* Bertol) was listed as a waif along the eastern seaboard by Gleason (1952), and Voss (1967) noted the occurrence of plants possibly representing this species in southwestern Michigan. In a number of respects *V. thapsiforme* specimens from Michigan resemble *V. phlomoides* but have strongly decurrent leaf bases. The taxonomic status of plants conforming to *V. thapsiforme* obviously warrants further study. It is hoped that readers will report additional occurrences in the state.

We gratefully acknowledge the aid of Raymond B. Cranfill in carrying out this project. The state and county police officers kindly allowed us to make studies along the highway.

LITERATURE CITED

- Ferguson, I. K. 1972. Scrophulariaceae. In T. G. Tutin et al., *Flora Europaea*. Vol. 3. xxix + 370 pp. University Press, Cambridge.
- Fernald, M. L. 1970. *Gray's Manual of Botany*. 8th ed. lxiv + 1632 pp. Van Nostrand Co., New York.
- Gleason, H. A. 1968. *The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada*. Vol. 3. Hafner Publ. Co., New York.
- Voss, E. G. 1967. The status of some reports of vascular plants from Michigan. *Mich. Bot.* 6:13-24.

REVIEWS

A GUIDE TO THE LITERATURE ON THE HERBACEOUS VASCULAR FLORA OF ONTARIO. By James L. Hodgins. 1979. Botany Press, 90 Wolfrey Ave., Toronto, Ontario, M4K 1K8. 73 pp.—\$4.00 (Canadian).

This is a new expanded edition of a 1977 guide. Its stated purpose is to allow swift public access to the botanical literature on Ontario plants. It has general sections on Floras and Field Guides; Food, Medicine and Crafts; Ecology; History; Horticulture; Miscellany; and Phytogeography. Included in these groups is basic literature of wide applicability as well as references specifically dealing with Ontario. There is also a section on journal articles dealing with the Ontario herbaceous flora but excluding 6 grasses and sedges. A preliminary list of local checklists and botanical surveys is included as well as a short list of periodicals for further reference and a list of Ontario herbaria. A provisional checklist of the herbaceous flora (excepting grasses and sedges) of Ontario is also appended.

As the book does not make claims of completeness, it cannot be accused of omissions, but the list is strongly lacking in older references. However, a particularly useful feature is an apparently complete listing of Ontario government floristic survey reports. This feature will be welcomed by all working on the flora of Ontario. For someone with an interest in the flora of this region this book will be a useful springboard to further knowledge. At four dollars it is reasonably priced and a welcome reference tool, though somewhat limited in scope.

—A. A. Reznicek

PUBLICATIONS OF INTEREST

ATLAS OF UNITED STATES TREES Volume 4. Minor Eastern Hardwoods. By Elbert L.

Little, Jr. U. S. Department of Agriculture Forest Service Miscell. Publ. 1342. 1977. 17 pp. + 230 maps. the first volume of this series (Conifers and Important Hardwoods) was reviewed in this journal in 1971 (Vol. 10, p. 207). Other recent volumes are Vol. 2 (Alaska Trees and Common Shrubs), Vol. 3 (Minor Western Hardwoods), and Vol. 5 (Florida). A sixth supplementary volume, with index to all maps plus maps for the hawthorns is predicted to complete the series. To say that this is the best set of distribution maps available for American trees and that it represents a prodigious amount of compilation is not to say that it is as accurate as one might hope. In Vol. 4, which is of local interest, numerous maps show major errors of commission and omission regarding distribution in Michigan, e. g. *Acer pennsylvanicum* in the western Upper Peninsula, *Amelanchier interior* in only a single county, *Celtis tenuifolia* not in Michigan at all, *Corylus cornuta* completely absent from the Lower Peninsula, *Salix pellita* not along the Lake Superior shore in Michigan or Ontario where it is common, *Salix pyrifolia* lacking almost any correlation with known Michigan localities, *Salix sericea* much farther north than specimens indicate, and *Sorbus decora* absent from large areas where herbarium specimens and published reports document its occurrence. This entire set shows production inconsistencies too often characteristic of the government Printing Office. Vol. 1 has a much larger page size than the rest of the set and is the only one in which the distributions are not shown in a second color. Only three of the five volumes are bound in hard covers. Although the actual scale of the larger-scale maps in Vols. 1, 3, & 4 seems to be the same, the borders have been cropped in the later volumes so that the corner checkpoints of overlays provided only in a pocket of Vol. 1 (for such features as climate, topography, hardness zones, and glacial borders) no longer match and it is very difficult to line up the overlays. While there are indeed 230 maps in Vol. 4, as stated on the back of the title page, they are not numbered from 1 to 230 nor are the pages bearing maps numbered at all.

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On the cover: Michigan Botanical Club
Spring Outing, Warren Woods, April 29-30, 1978.
Photo by Clayton Alway.

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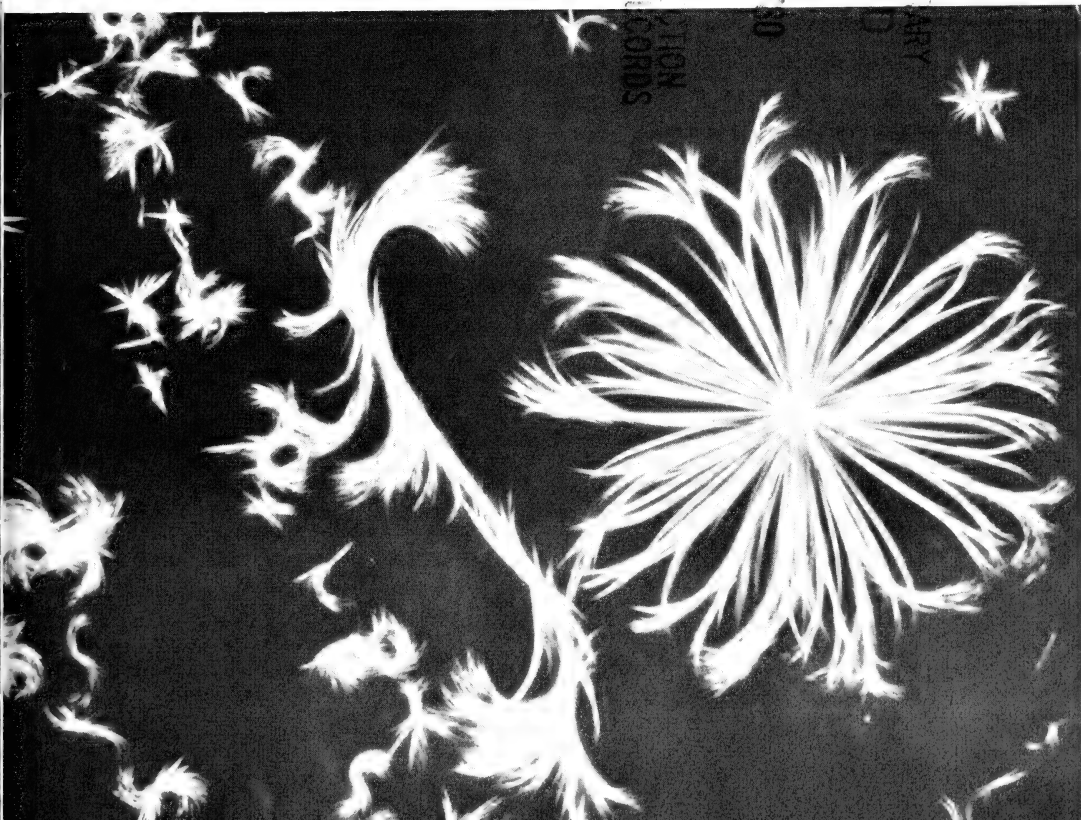
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**A STUDY OF BAKER WOODLOT.
III. CHECKLIST OF VASCULAR PLANTS**

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The previous parts of this study covered historical, physical, and ecological aspects of Baker Woodlot (Beach & Stevens 1979a, 1979b). Presented here is a checklist of vascular plants. All taxa have voucher specimens in the Beal-Darlington Herbarium, collected within the previously described woodlot boundaries. With one exception, *Glyceria septentrionalis*, all taxa in this list have been seen or collected in the woods in the course of this study. In the historical records a number of additional species have been noted for this area but not documented by specimens and thus are not included in the checklist. Although most of these records are dubious, two of them should be mentioned: Conant (undated) provided a list of species for the woods which includes the following interesting entries: *Amelanchier canadensis* (occurs locally and perhaps once present), *Cornus stolonifera* (often noted in the woods and likely present when the amount of disturbance was greater), *Populus grandidentata* (probably a misdetermination), *Nemopanthus mucronata* (perhaps once present, associated with the ponds, but more likely a misdetermination), *Rubus allegheniensis* (probably still present in the woods but not collected), and *Vitis vulpina* (perhaps once present but more likely a misdetermination). Giles (1941) included the following, among others, which occurred in or near the site of Baker Woodlot: *Aster laevis* ("noted in Woodlot 17," common locally and perhaps present), *Corallorhiza maculata* ("occasional in Woodlot 17," probably once present), *Epi-lobium glandulosum* var. *adenocaulon* ("seen in Woodlot 17, infrequent," perhaps once present), *Habenaria hookeri* ("woods south of the college." There are two specimens in the Beal-Darlington Herbarium from this area, collected 14 June 1866 and 16 June 1894; this is an example of a species which occurred in the original forest but is probably not preserved in the remaining woodlots), *Ranunculus pensylvanicus* ("occasional in moist places in Woodlot 17," occurring locally and perhaps once present), and *Sanicula marilandica* ("Woodlot 17," probably a misdetermination). Some other plants should be mentioned: *Juglans cinerea* nuts have occasionally been found in the woods, but a voucher has not been prepared. *Sium suave* has recently been seen but not collected. During

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this study, ornamental species of *Juniperus* and *Betula* have been planted on the edge of, but not in the woods.

The checklist includes 87 families, 232 genera, and 372 species. Of these, 289 species are native, 73 introduced, and 10 are planted. The largest family is Asteraceae with 39 species; six other families have ten or more species; Caprifoliaceae, Cyperaceae, Liliaceae, Poaceae, Ranunculaceae, and Rosaceae. The largest genus is *Carex* with 13 species; ten other genera have five or more species: *Acer*, *Aster*, *Crataegus*, *Lonicera*, *Polygonum*, *Prunus*, *Quercus*, *Solidago*, *Viburnum*, and *Viola*.

The format and sources of information follow those of Beaman (1970). The major collectors have been abbreviated as B—J. H. Beach, F—R. A. Flanders, S—W. D. Stevens, and T—W. G. Thomas.

EQUISETOPHYTA

EQUISETACEAE

- Equisetum arvense* L. Field horsetail. Disosway 23. In SE corner of woods.
E. hyemale L. Scouring-rush. F 168. In central woods.

POLYPODIOPHYTA

OPHIOGLOSSACEAE

- Botrychium dissectum* Sprengel. Cut-leaved grape fern. F 194. In central woods.
B. virginianum (L.) Sw. Rattlesnake Fern. F 64; S 849, 966. Scattered in rich central and S-central woods.

OSMUNDACEAE

- Osmunda cinnamomea* L. Cinnamon fern. Bordner 115. Near edge of middle W pond, rare.
O. claytoniana L. Interrupted fern. B 1098B, 1182; Bordner 123; S 959. Common around W ponds.
O. regalis L. Royal fern. B 1098A; S 957. Occasional around W ponds.

POLYPODIACEAE

- Adiantum pedatum* L. Maidenhair fern. Bordner 116; F 17; S 962. Scattered in rich S-central woods.
Athyrium filix-femina (L.) Roth. Lady fern. Bordner 119; F 72, 85, 162; S 964. Scattered through woods.
Cystopteris fragilis (L.) Bernh. Fragile fern. F 207B. Central woods, Apparently rare.
Dryopteris spinulosa (O. F. Mueller) Watt. Spinulose shield-fern. S 963, 965, 967, 970, 971. Scattered in central and S-central woods.
Onoclea sensibilis L. Sensitive fern. F 73; S 961. Scattered through woods, especially in wet places.
Polystichum acrostichoides (Michaux) Schott. Christmas fern. B 1138; F 92; S 969. Scattered in central and S-central woods.
Thelypteris noveboracensis (L.) Nieuwl. New York fern. B 1097; 1099; Bordner 124; F 79; Quimby 10; S 958. Scattered throughout woods.

PINOPHYTA

PINACEAE

Pinus ponderosa Lawson. Yellow pine. B 1120. Planted in S end.

P. strobus L. White pine. S 944. A few very stunted trees in W-central woods, probably planted.

Pseudotsuga menziesii (Mirbel) Franco. Douglas-fir. S 858. Stunted trees scattered in S and W woods; planted.

Tsuga canadensis (L.) Carr. Hemlock. B 1005. One small tree along N edge, probably a nursery relic.

CUPRESSACEAE

Thuja occidentalis L. Arbor vitae. S 885. Planted in NW corner with black walnuts; many surviving until 1970 when all but one were removed by road construction.

TAXACEAE

Taxus sp. Yew. S 1670. Several seedlings scattered in central woods, probably adventive.

MAGNOLIOPHYTA

MAGNOLIOPSIDA

MAGNOLIIDAE

MAGNOLIACEAE

Liriodendron tulipifera L. Tulip-poplar. S 955; T 65. Scattered large trees in N and W woods. Flowering in June.

LAURACEAE

Lindera benzoin (L.) Blume. Spicebush. B 1140; Grashoff 50; S 270; T 76. Common in wet areas. Flowering in April.

Sassafras albidum (Nutt.) Nees. Sassafras. B 1221; S 306, 324, 362; T 72. Scattered canopy trees throughout woods and smaller trees common along E and S edges. Flowering in May.

ARISTOLOCHIACEAE

Asarum canadense L. Wild ginger. F 19, 48; 312. Common in rich central and S-central woods. Flowering April-June.

RANUNCULACEAE

Actaea pachypoda Ell. White baneberry. B 1075; Disosway 79; Heaton 65; S 331, 805; T 49. Scattered throughout woods. Flowering May-July.

A. rubra (Aiton) Willd. Red baneberry. F 63; S 327. Uncommon. Flowering May-June.

Anemone canadensis L. B 1017; S 358. Weedy along S and E edges. Flowering May-July.

A. quinquefolia var. *interior* Fern. Wood anemone. F 1; S 1533. Uncommon. Flowering April-May.

Aquilegia canadensis L. Wild columbine. Shipman 36; S 343. Scattered in SW woods and along S edge.

Clematis virginiana L. Virgin's-bower. B 1131. One large patch along S edge. Flowering July-August.

Hepatica acutiloba DC. Liverleaf. B 1073; S 278, 326. Uncommon, in SE woods. Flowering April-May.

Hydrastis canadensis L. Golden-seal. F 100, 255; Gillis 6770; S 844. Scattered, especially in rich S-central woods. Flowering in May.

- Ranunculus abortivus* L. Kidneyleaf-buttercup. S 291. Weedy on N edge and along trails. Flowering May-June.
R. recurvatus Poir. S 911. Uncommon in NW woods. Flowering May-June.
R. septentrionalis Poir. Rabeler 125. Uncommon in SW woods. Flowering April-June.
Thalictrum dasycarpum Fischer & Lall. Purple meadow-rue. B 1045. Apparently rare, S woods. Flowering June-July.
T. dioicum L. Early meadow-rue. F 11; S 301. Scattered through woods. Flowering April-May.

BERBERIDACEAE

- Berberis thunbergii* DC. Japanese barberry. S 300. Scattered through woods. Flowering April-May.
B. vulgaris L. Common barberry. S 2170. Near NW pond. Flowering May-June.
Caulophyllum thalictroides (L.) Michaux. Blue cohosh. Grashoff 49; S 296, 804; T 48. Scattered through woods, uncommon. Flowering April-May.
Podophyllum peltatum L. May-apple. B 1010; Ehrlinger 73; F 7; S 329. Common, in large patches. Flowering in May.

MENISPERMACEAE

- Menispermum canadense* L. Moonseed. S 814. Occasional in S-central woods. Flowering June-July.

PAPAVERACEAE

- Chelidonium majus* L. Celandine. F 78; S 1082. Occasional adventive, scattered through woods. Flowering May-June.
Sanguinaria canadensis L. Bloodroot. F 43; Grashoff 51; S 271, 344; Suttkus 16. Scattered through woods. Flowering April-May.

HAMAMELIDAE

PLATANACEAE

- Platanus occidentalis* L. Sycamore. S 2151; T 84. Uncommon, in wet places. Flowering in May.

HAMAMELIDACEAE

- Hamamelis virginiana* L. Witch-hazel. S 361; T 34. Common in SW woods. Flowering September-October.

ULMACEAE

- Celtis occidentalis* L. Hackberry. S 855; T 75. Uncommon. S woods near drainage ditch. Flowering in May.
Ulmus americana L. American elm. S 901. Once common in wet places but mostly killed by Dutch elm disease. Flowering in April.
U. rubra Muhl. Slippery elm. S 861, 2096. Occasional, in disturbed places. Flowering April-May.

CANNABACEAE

- Cannabis sativa* L. Hemp. B 1288. Several plants seen along E edge in 1974, probably planted and not persisting. Flowering July-August.

URTICACEAE

- Boehmeria cylindrica* (L.) Sw. False nettle. F 126, 144, 147. Common in wet places. Flowering June-August.

- Laportea canadensis* (L.) Wedd. Wood-nettle. F 80; S 1616. Common, especially in disturbed places. Flowering June–August.
- Pilea pumila* (L.) Gray. Clearweed. F 143; Heaton 73; S 2098. In wet disturbed places around ponds. Flowering August–September.
- Urtica dioica* ssp. *gracilis* (Aiton) Selander. Nettle. F 204; S 1608. Weedy in woods near center of S edge. Flowering July–August.

JUGLANDACEAE

- Carya cordiformis* (Wang.) K. Koch. Bitternut hickory. S 2135; T 35. In S woods, apparently rare. Flowering in May.
- C. ovata* (Miller) K. Koch. Shagbark hickory. S 893; T 80. Uncommon. Flowering in May.
- Juglans nigra* L. Black walnut. S 888; T79. Planted in NW corner; road widening and changes in drainage have eliminated most individuals. Flowering in May.

FAGACEAE

- Fagus grandifolia* Ehrh. Beech. B 1222; S 883; T 83. A dominant tree in the drier areas of W woods, scattered elsewhere. Flowering in May.
- Quercus alba* L. White oak. S 863A, 894. Common, especially in S woods. Flowering in May.
- Q. bicolor* Willd. Swamp white oak. S 847, 1085D. Common in wet places in S woods. Flowering in May.
- Q. macrocarpa* Michaux. Bur oak. S 63B, 2148. A few trees in S woods. Flowering May–June.
- Q. muehlenbergii* Engelm. Chestnut oak. S 2583. Rare, in SE woods. Flowering May–June.
- Q. rubra* var. *borealis* (Michaux f.) Farw. Northern red oak. B 1128A, 1145, 1147; S 321, 857. Common in drier areas. Flowering in May.

BETULACEAE

- Carpinus caroliniana* Walter. Ironwood. S 287; T 71. Common in low places in S woods. Flowering April–May.
- Corylus americana* Walter. American hazelnut. Anderson 2354. On S side near W edge. Flowering April–June.
- Ostrya virginiana* (Miller) K. Koch. Hop hornbeam. S 288; T 67. Uncommon, scattered through woods. Flowering April–May.

CARYOPHYLLIDAE

PHYTOLACCACEAE

- Phytolacca americana* L. Pokeweed. B 1051; F 211; S 810; T 33. Common in openings in NE woods and along E edge. Flowering June–October.

CARYOPHYLLACEAE

- Lychnis alba* Miller. White campion. S 322; T 31. Weedy along edges. Flowering May–October.
- Saponaria officinalis* L. Bouncing Bet. T 21. Weedy along S edge. Flowering July–October.
- Stellaria longifolia* Muhl. S 1574. Uncommon, along S edge. Flowering May–July.
- S. media* (L.) Cyrillo. Common chickweed. S 860. Common in disturbed places. Flowering May–July.

PORTULACACEAE

- Claytonia virginica* L. Spring beauty. F 48; Grashoff 46; S 272. Common in all but the wettest parts of the woods. Flowering March–May.

CHENOPODIACEAE

- Chenopodium album* L. Lamb's quarters. S 2139. Occasional weed along E edge. Flowering July–September.
Salsola kali L. Russian thistle. T 30. Occasional, weedy on railroad ballast along S side. Flowering May–September.

POLYGONACEAE

- Polygonum aviculare* L. Knotweed. S 2140. Uncommon weed along E edge. Flowering July–October.
P. lapathifolium L. Smartweed. S 2133. Occasional in low wet area of NW corner. Flowering July–August.
P. pensylvanicum L. Pinkweed. S 2132; T 32. Common in low wet area of NW corner. Flowering July–October.
P. persicaria L. Lady's-thumb. B 1189. Occasional in low wet area of NW corner. Flowering June–September.
P. scandens L. False buckwheat. S 2095. Weedy in NW corner. Flowering August–September.
P. virginianum L. Jumpseed. B 1091, 1135; F 105; S 2118. Common throughout woods. Flowering July–September.
Rumex crispus L. Sour dock. S 1569. Weedy along E and S edges. Flowering in June.
R. obtusifolius L. Bitter dock. B 1232. Scattered along E edge. Flowering June–August.

DILLENIIDAE

HYPERICACEAE

- Hypericum perforatum* L. S 2122. Occasional along S edge. Flowering June–September.
H. punctatum Lam. B 1086. Occasional along S edge. Flowering June–August.

TILIACEAE

- Tilia americana* L. Basswood. Morse 363, 5902; T 63. Moderately common throughout woods. Flowering May–June.

VIOLACEAE

- Viola canadensis* L. Canadian violet. F 102; S 293, 318. Near drainage ditch on E side. Flowering April–October.
V. conspersa Reichenb. American dog-violet. S 1081C. Rare, near S trail. Flowering April–June.
V. papilionacea Pursh. Meadow violet. S 285. Weedy along N edge, probably from nursery. Flowering May–October.
V. pubescens var. *eriocarpa* (Schw.) Russell. Yellow violet. B 1002; F 25; S 277, 319, 320. Common in all but the wettest areas. Flowering April–June.
V. rostrata Pursh. Long-spurred violet. F 256; S 297; Suttkus 14. Occasional in rich central woods. Flowering April–May.
V. sororia Willd. Woolly blue violet. F 9; S 281, 304, 334; Suttkus 24. Occasional throughout woods. Flowering April–June.
V. striata Aiton. Cream violet. Atwood 365. Rare, SE corner. Flowering April–July.

SALICACEAE

- Populus canescens* (Aiton) Sm. Gray poplar. S 851. A few small trees along S edge; apparently a rarely escaped species in Michigan. Flowering April–May.
P. deltoides Marsh. Cottonwood. S 2582; T 74. Uncommon, large trees scattered in wet places and small trees along SE edges. Flowering April–May.

- P. tremuloides* Michaux. Aspen. S 848. Common, small trees along S edge. Flowering in April.
Salix bebbiana Sarg. Beaked willow. S 1677. Along S edge. Flowering April–May.
S. interior Rowlee. Sandbar willow. B 1022; S 912, 1675. Along S edge. Flowering May–June.
S. nigra Marsh. Black willow. S 884. Around NW pond, uncommon. Flowering May–June.
S. petiolaris Sm. S 1678. Along S edge. Flowering April–May.

BRASSICACEAE

- Barbarea vulgaris* R. Br. Yellow rocket. S 866. Weedy along edges and trails. Flowering May–August.
Berteroa incana (L.) DC. Hoary alyssum. B 1055; F 224; T 26. In drier disturbed places. Flowering June–November.
Capsella bursa-pastoris (L.) Medicus. Shepherd's purse. S 907. Weedy along N side. Flowering May–October.
Cardamine douglassii (Torrey) Britton. Bitter cress. F 240; S 276, 323. Common in low wet areas of rich central woods. Flowering April–May.
Dentaria laciniata Muhl. Toothwort. S 247; Suttkus 13. Common throughout woods. Flowering April–May.
Hesperis matronalis L. Dame's violet. B 1227; S 899. Abundant in NW corner. Flowering in May.
Lepidium virginicum L. Pepper-grass. S 2146. Occasional weed on E edge. Flowering May–September.
Sisymbrium altissimum L. Tumbling mustard. B 1228; S 1570. Weedy along S edge and in NW corner. Flowering May–August.
Thlaspi arvense L. Penny cress. S 906. Weedy along N edge. Flowering April–October.

PRIMULACEAE

- Lysimachia ciliata* L. Loosestripe. B 1050, 1084. Scattered in S woods. Flowering June–August.

ROSIDAE

HYDRANGEACEAE

- Philadelphus coronarius* L. Mock orange. S 939. A few large shrubs along N edge, relics of nursery. Flowering June–July.

GROSSULARIACEAE

- Ribes americanum* Miller. Wild black currant. S 316. Uncommon, near W entrance. Flowering April–June.
R. cynosbati L. Prickly gooseberry. B 1003; S 302, 845. Scattered in woods. Flowering April–May.

SAXIFRAGACEAE

- Mitella diphylla* L. Bishop's cap. F 24; S 289. Moderately common in rich S-central woods. Flowering April–June.
Saxifraga pensylvanica L. Swamp-saxifrage. B 1007. Rare, rich S-central woods. Flowering May–June.

ROSACEAE

- Agrimonia gryposepala* Wallr. B 1072; Craig 6869; S 1610. Relatively common in drier areas. Flowering July–August.

- A. pubescens* Wallr. B 1059; F 156. Apparently uncommon, drier areas. Although not noted by Beaman (1970) for Sanford Natural Area, a specimen, Marshall 274, was collected there in 1948. It must be rare or no longer present in that woodlot. Flowering July–September.
- Amelanchier arborea* (Michaux f.) Fern. Service berry. Anderson 2241, 2357; B 1219; S 284, 895. Common in drier areas of N and W woods. Flowering April–May.
- Crataegus calpodendron* (Ehrh.) Medicus. B 1015, 1224. Uncommon, W edge. Flowering May–July.
- C. crus-galli* L. S 808, 914, 2153. Common in central and S woods. Flowering in June.
- C. fontanesiana* (Spach) Steudel. S 2150. One tree found, S woods. Flowering May–June.
- C. macrosperma* Ashe. S 856, 887. In dry areas, N and W woods, Flowering May–June.
- C. mollis* (Torrey & Gray) Scheele. S 1672, 2152. One tree found, S edge. Flowering March–June.
- C. punctata* Jacq. S 1083, 2134, 2154. Scattered. Flowering May–June.
- Fragaria virginica* Duchesne. Strawberry. S 2155. Common along S edge. Flowering April–June.
- Geum canadense* Jacq. Avens. B 1028, 1081; F 59, 139; S 946, 1567, 1582, 1618. Common in drier places. Flowering June–August.
- Potentilla intermedia* L. B 1166; S 2121; T 8. Weedy along S edge. Flowering June–October.
- P. recta* L. T 28. Weedy in SW corner. Flowering June–August.
- P. simplex* Michaux. Old-field cinquefoil. S 359, 1534. Weedy along S and E edges. Flowering May–June.
- Prunus americana* Marsh. Wild plum. S 850, 1673, 2137. Uncommon, along S edge. Flowering in May.
- P. avium* L. Sweet cherry. S 877. One well-formed tree in deep woods along S trail. Flowering in May.
- P. incisa* Thunb. S 283, 833, 891. Scattered in N half of woods, apparently adventive from nursery. Flowering in May.
- P. malahebb* L. Malahebb-cherry. S 2584. Three shrubs on E edge, perhaps planted. Flowering in May.
- P. serotina* Ehrh. Black cherry. B 1220; S 886; T 70. Scattered through woods, relatively common. Flowering in May.
- P. triloba* Lindley. Flowering almond. B 1216, 1287. Along E part of N edge, apparently a nursery relic. Flowering April–May.
- P. virginiana* L. Choke cherry. B 1008; S 315, 360. Forming dense thickets in S end. Flowering May–June.
- Rhodotypos scandens* (Thunb.) Makino. Jetbead. S 325. One shrub in E-central woods, probably adventive from nursery. Flowering in May.
- Rosa carolina* L. B 1225; S 1573. Common along S and W edges. Flowering June–August. Another species occurs around the W ponds but flowers rarely; the single specimen, Morse 5895, has not been determined.
- R. multiflora* Thunb. B 1199; S 938, 1558. One large thicket along E edge, probably planted. Flowering June–July.
- Rubus occidentalis* L. Black raspberry. B 1054; S 1559, 1622. Scattered in woods. Flowering May–June.
- R. strigosus* Michaux. Red raspberry. Disosway 45; S 1623. Scattered. Flowering June–July.
- Spiraea alba* DuRoi. Meadow-sweet. B 1082; S 2102. Common in open areas along S edge. Flowering June–September.

FABACEAE

- Amphicarpaea bracteata* (L.) Fern. Hog peanut. F 57, 74, 183. Scattered in central woods. Flowering July–September.
- Desmodium glutinosum* (Muhl.) Wood. B 1053, 1058; F 69; S 1615. Common in central woods. Flowering July–August.

- D. nudiflorum* (L.) DC. F 106, 109, 159. Scattered through woods. Flowering July–August.
- D. paniculatum* (L.) DC. B 1165. Uncommon, S edge near E side. Flowering July–September.
- Lotus corniculatus* L. Bird's-foot trefoil. F 46. Occasional weed along N and E sides. Flowering May–September.
- Melilotus alba* Desr. White sweet clover. T 23. Weedy along S edge. Flowering June–October.
- M. officinalis* (L.) Lam. Yellow sweet clover. S 1572; T 45. Weedy along S edge. Flowering June–October.
- Robinia pseudo-acacia* L. Black locust. Maas 534; S 918. Planted in old nursery along S edge, now adventive. Flowering May–June.
- Trifolium repens* L. White clover. T 37. Occasional adventive from field along S half of E side. Flowering May–September.

ONAGRACEAE

- Circaea quadrisulcata* var. *canadensis* (L.) Hara. Enchanter's nightshade. F 58, 75; S 1617. Relatively common in rich central woods. Flowering June–August.
- Epilobium coloratum* Biehler. B 1180. Occasional in S woods. Although not noted by Beaman (1970) for Sanford Natural Area, a specimen, Marshall 287, was collected there in 1948. Flowering August–September.
- Oenothera parviflora* L. Evening primrose. B 1079; T 25. Weedy along S edge. Flowering July–September.

NYSSACEAE

- Nyssa sylvatica* Marsh. Black gum. Anderson 2347. Common around central W pond, occasional in E central woods. Flowering May–June.

CORNACEAE

- Cornus alternifolia* L. f. Green osier. F 103, 192; S 353. Occasional in wet places throughout woods. Flowering May–June.
- C. florida* L. Flowering dogwood. Anderson 2350; F 133; S 346, 800; T 66. Several small trees in SW woods. Flowering in May.
- C. foemina* ssp. *racemosa* (Lam.) J. S. Wilson. Anderson 2356; B 1013, 1223; S 815, 1571. Forming dense thickets around shaded pond margins. Flowering May–June.

CELASTRACEAE

- Celastrus scandens* L. Climbing bittersweet. Anderson 2261; S 913. Common along S edge. Flowering May–June.
- Euonymus obovatus* Nutt. Running strawberry-bush. B 1071; F 150; S 352. Scattered through woods, locally abundant. Flowering May–June.

AQUIFOLIACEAE

- Ilex opaca* Aiton. American holly. B 1006. Planted in early 1970's within N edge of woods. Flowering material lacking in Beal-Darlington Herbarium.
- I. verticillata* (L.) Gray. Black alder. Anderson 2349; B 1119; Morse 5904, 5906; S 1612. Common around W ponds. Flowering June–July.

RHAMNACEAE

- Rhamnus cathartica* L. Common buckthorn. Anderson 2243; S 871, 1084. Scattered in SW woods. Flowering in May.
- R. frangula* L. Alder-buckthorn. S 892. Rare, S-central woods. Flowering May–June.

VITACEAE

- Parthenocissus quinquefolia* (L.) Planchon. Virginia creeper. S 2145. Common low vine. Flowering in June.

P. vitacea (Knerr) Hitchc. Virginia creeper. S 1565. Common along S edge. Flowering June–July.

Vitis aestivalis Michaux. Summer grape. F 140; S 1555. Forming dense thickets along E edge and occasionally within woods. Flowering in June.

V. riparia Michaux. Frost grape. B 1016; Ehrlinger 76; S 354. Scattered throughout woods, sometimes climbing into canopy. Flowering May–June.

STAPHYLEACEAE

Staphylea trifolia L. Bladdernut. S 881. Rare, S-central woods. Flowering May–June.

HIPPOCASTANACEAE

Aesculus hippocastanum L. Horse-chestnut. F 165. One small tree, adventive in central woods. Flowering in May.

ACERACEAE

Acer negundo L. Box-elder. B 1217, 1218; S 279. Common along drainage ditch in SE woods and in NW corner. Flowering April–May.

A. platanoides L. Norway maple. Duvendeck 61; S 897. Adventive or planted along N side. Flowering April–May.

A. rubrum L. Red maple. Hamel 115, 116; S 309, 896; T 68. Common, especially in wet places. Flowering April–May.

A. saccharinum L. Silver maple. S 864. Occasional in wet places in SE woods. Flowering April–May.

A. saccharum var. *nigrum* (Michaux f.) Britton. Black maple. B 1187; S 954. Occasional throughout woods; specimens collected as extreme examples of this variety which intergrades with the next in this woodlot. Flowering April–May.

A. saccharum Marsh. var. *saccharum*. Sugar maple. Hamel 117, 118; S 831. A dominant tree in all but the wettest places. Flowering April–May.

ANACARDIACEAE

Rhus typhina L. Staghorn sumac. Duvendeck 59; S 943; T 82. Locally common along S and W edges. Flowering in June.

Toxicodendron radicans ssp. *negundo* (Greene) Gillis. Poison-ivy. B 1026; F 81. Common, especially where wet. Flowering in June.

RUTACEAE

Zanthoxylum americanum Miller. Prickly-ash. S 313, 802; T 64. Common and forming thickets in wet parts of S woods. Flowering in May.

OXALIDACEAE

Oxalis stricta L. Wood-sorrel. B 1060; F 208; S 949, 1598. Occasional weed throughout woods. Flowering May–August.

GERANIACEAE

Geranium maculatum L. Crane's-bill. F 6; S 351. Scattered, especially in SE woods. Flowering May–June.

BALSAMINACEAE

Impatiens noli-tangere ssp. *biflora* (Walter) Hultén. Spotted touch-me-not. F 212; T 40. Locally common in wet, disturbed places. Flowering July–September.

ARALIACEAE

Aralia nudicaulis L. Wild sarsaparilla. F 181; S 882. Relatively common along S part of W trail. Flowering May–June.

- A. racemosa* L. Spikenard. B 1129. Rare, in rich S-central and W woods. Flowering in July.
Panax quinquefolius L. Ginseng. B 1143; F 83; S 955. Scattered in rich S-central woods. Flowering May–June.
P. trifolius L. Dwarf ginseng. F 257; S 305. In central woods, rare. Flowering April–May.

APIACEAE

- Cicuta maculata* L. Water-hemlock. B 1041; S 1609. Scattered in wet places in S-central woods. Flowering July–September.
Cryptotaenia canadensis (L.) DC. Honewort. B 1024; F 50A, 61; S 945. Scattered through woods. Flowering June–July.
Daucus carota L. Wild carrot. S 1607; T 1. Occasional weed around edges. Flowering June–October.
Osmorhiza claytoni (Michaux) C. B. Clarke. Sweet cicely. F 52. Apparently rare, SE woods. Flowering May–June.
O. longistylis (Torrey) DC. Anise root. Disosway 85; F 89A; S 355. Common in SE woods. Flowering May–June.
Sanicula gregaria Bickn. Black snakeroot. B 1033; F 51A, 89B; S 356. Scattered in drier areas. Flowering May–July.
S. trifoliata Bickn. Black snakeroot. F 77, 152. Uncommon, in central and S-central woods. Flowering May–July.
Torilis japonica (Houtt.) DC. Hedge-parsley. B 1049, 1076; F 215. Occasional weed along edges and trails. Flowering July–August.

ASTERIDAE

GENTIANACEAE

- Gentiana andrewsii* Griseb. Closed gentian. S 2107. Common along S edge, in shade. Flowering August–October.

APOCYNACEAE

- Apocynum androsaemifolium* L. Indian hemp. B 1056; S 947. Common near W entrance. Flowering June–August.
A. cannabinum L. Dogbane. S 1566. Occasional along S edge. Flowering May–September.
Vinca minor L. Periwinkle. B 1001; S 1085A. Introduced in NE corner from flats of nursery plants, thriving and spreading vegetatively. Flowering May–June.

ASCLEPIADACEAE

- Asclepias incarnata* L. Swamp milkweed. B 1065, 1124; S 2105. Occasional in NW pond and in wet places along S edge. Flowering June–August.
A. syriaca L. Common milkweed, S 1596. Common in fields along E side and occasionally within edge of woods. Flowering June–August.
Vincetoxicum nigrum (L.) Moench¹ S 2097. One small vine along W trail near entrance. Flowering May–July.

¹This introduced European species is listed in most floras of eastern North America as *Cynanchum nigrum* (L.) Pers., a later homonym of *C. nigrum* Cav. Although *Vincetoxicum* is a segregate of *Cynanchum* hardly worth recognition, no legitimate name for the species has been found under *Cynanchum*.

SOLANACEAE

- Physalis heterophylla* Nees. Ground-cherry. S 1568. Uncommon, along S edge in dry places. Flowering June–September.
Solanum dulcamara L. Red nightshade. B 1154; S 1579. Weedy around ponds. Flowering June–August.
S. nigrum L. Black nightshade. B 1074; F 213. Locally common in NE woods where opened by logging. Flowering July–October.

CONVOLVULACEAE

- Convolvulus arvensis* L. Bindweed. B 1031. Weed along S edge. Flowering June–August.

POLEMONIACEAE

- Phlox divaricata* L. Phlox. F 23; S 303. Moderately common, in rich central and SW woods. Flowering April–June.

HYDROPHYLLACEAE

- Hydrophyllum appendiculatum* Michaux. Waterleaf. S 342. Rare, along central trail. Flowering May–July.

VERBENACEAE

- Verbena urticifolia* L. White vervain. F 110; S 1599. Occasional, along E side. Flowering July–August.

PHRYMACEAE

- Phryma leptostachya* L. Lopseed. B 1094; F 76; S 1611. Occasional in rich central and S-central woods. Flowering June–August.

LAMIACEAE

- Agastache nepetoides* (L.) Kuntze. Yellow giant hyssop. Anderson 2173; B 1116, 1142; F 206. Scattered in rich parts of woods; these specimens are the only ones in Beal-Darlington Herbarium from this or any nearby county. Flowering August–September.
Collinsonia canadensis L. Horse-balm. B 117; F 163; S 2120; T9. Common in rich parts of woods. Flowering August–October.
Leonurus cardiaca L. Common motherwort. S 1554. One patch in disturbed area near NE corner. Flowering June–October.
Mentha arvensis L. S 2114. Occasional weed along S edge. Flowering July–September.
Monarda fistulosa L. Wild bergamot. B 1083; S 1604. Common in woods near center of S edge. Flowering June–August.
Prunella vulgaris L. Selfheal. B 1070; T 3. Occasional weed on edges. Flowering June–October.
Scutellaria lateriflora L. Mad-dog skullcap. B 1136; F 216. Scattered in rich S-central woods. Flowering May–August.

PLANTAGINACEAE

- Plantago lanceolata* L. Ribgrass. T 22. Occasional weed on edges. Flowering June–October.
P. rugelii Decne. Plantain. S 812. Uncommon along S trail, in water. Flowering July–September.

OLEACEAE

- Fraxinus americana* L. White ash. Ozoga 19, S 830, 889, 2157; T 62. Moderately common throughout woods. Flowering in May.

- F. nigra* Marsh. Black ash. Anderson 2348. Frequent around middle W pond. Flowering May–June.
- F. pennsylvanica* Marsh. Green ash. B 1201, 1203; S 1073, 2158. Scattered around edges, especially where wet. Flowering in May.
- Ligustrum obtusifolium* Sieb. & Zucc. Privet. B 1039; S 940. Common in NE corner, probably adventive from nursery or planted. Flowering June–July.

SCROPHULARIACEAE

- Chelone glabra* L. Turtlehead. S 2115. Occasional along S edge. Flowering July–September.
- Linaria vulgaris* Hill. Butter-and-eggs. B 1160; T 2. Weedy along S and E edges. Flowering June–October.
- Mimulus ringens* L. Monkey-flower. B 1069. Common on S edge near end of drainage ditch. Flowering June–September.
- Verbascum blattaria* L. Moth mullein. S 2147. Uncommon weed along E side. Flowering June–September.
- V. thapsus* L. Common mullein. S 2156. Common along S side. Flowering June–August.

OROBANCHACEAE

- Conopholis americana* (L.) Wallr. Squaw-root. B 1038, 1233; Stanis 23. Root parasite, scattered but uncommon. Flowering May–June.
- Epifagus virginiana* (L.) Bart. Beech-drops. F 214; S 801; T 47. Common root parasite on beech. Flowering July–October.

BIGNONIACEAE

- Catalpa speciosa* Warder. Catalpa. S 937. One large tree along E edge near drainage ditch, probably planted. Flowering in June.

CAMPANULACEAE

- Campanula americana* L. Tall bellflower. B 1061; F 101; S 813; T 17. Scattered through woods. Flowering June–October.
- Lobelia cardinalis* L. Cardinal-flower. B 1067. On S edge in wet places, rare. Flowering July–October.
- L. syphilitica* L. Blue cardinal-flower. B 1139. Scattered in S part of woods. Flowering August–October.

RUBIACEAE

- Cephalanthus occidentalis* L. Buttonbush. B 1122; Morse 5901. Common in and around W ponds. Flowering June–August.
- Galium aparine* L. Cleavers. F 238; S 846. Scattered through woods, especially where disturbed. Flowering April–June.
- G. circaezans* Michaux. Wild licorice. B 1042; F 137; S 956. Common in central and S-central woods. Flowering May–July.
- G. lanceolatum* Torrey. Wild licorice. F 84. In S-central woods, rare. Flowering May–July.
- G. triflorum* Michaux. Sweet-scented bedstraw. B 1127; F 70, 124, 148. Common throughout woods. Flowering May–July.
- Mitchella repens* L. Partridge-berry. B 1123; S 1621. One large patch near SW pond. Flowering June–July.

CAPRIFOLIACEAE

- Diervilla lonicera* Miller. Bush honeysuckle. B 1023; S 950. In dry sandy places in W and S woods, uncommon. Flowering June–July.

- Lonicera canadensis* Marsh. Fly honeysuckle. Gillis 6484; S 299. Uncommon, along W trail. Flowering April–May.
- L. dioica* L. Wild honeysuckle. Rabeler 128; S905. Rare, in W woods. Flowering May–June.
- L. maackii* Maxim. B 1021. Along edges in NE corner of woods. Flowering in June.
- L. tatarica* L. Tartarian honeysuckle. S 317, 902. Scattered in disturbed places, especially near center of S edge. Flowering May–June.
- L. ?xylostemum* L. Fly honeysuckle. Morse 5901. Edge of woods near central W pond; the specimen, with a single fruit, might represent *L. morrowii* or some other introduced *Lonicera*. Flowering in May.
- Sambucus canadensis* L. Common elder. Heaton 75A; S 1597. Occasional, in disturbed places around edges. Flowering June–August.
- S. pubens* Michaux. Red-berried elder. B 1011; S 310. Common in disturbed places, especially in NE woods. Flowering April–June.
- Triosteum aurantiacum* Bickn. Horse gentian. Anderson 2181; B 1141; S 1077. Scattered in drier parts of woods. Flowering May–June.
- Viburnum acerifolium* L. Arrow-wood. F 104; Hamel 107; Heaton 54; S 811, 948, 1613. Common in drier places. Flowering May–June.
- V. lantana* L. Wayfaring tree. F 158. Rare adventive in woods. Flowering May–June.
- V. lentago* L. Sheepberry. S 1080. Occasional in S half of woods. Flowering May–June.
- V. opulus* L. Highbush-cranberry. B 1184; Hamel 108; S 348. Scattered in N woods. Flowering May–July.
- V. plicatum* Thunb. B 1186; S 900, 1058B. Scattered in central woods. Flowering May–June.
- V. rafinesquianum* Schultes. Downy arrow-wood. F 193; S 345, 1671. Scattered through woods. Flowering May–June.
- V. recognitum* Fern. Arrow-wood. S 2580. One cluster of small plants in central woods. Flowering material lacking in Beal-Darlington Herbarium.

DIPSACACEAE

- Dipsacus laciniatus* L. Teasel. S 2131. Occasional weed along S and E edges. Flowering July–August.

ASTERACEAE

- Achillea millefolium* L. Common yarrow. B 1014, 1032; T 27. Common along S and E edges. Flowering May–October.
- Ambrosia artemisiifolia* L. Common ragweed. S 2108. Weedy along S and W edges. Flowering August–September.
- Antennaria plantaginifolia* (L.) Richards. Pussy's-toes. S 1074. Common along W edge. Flowering April–May.
- Arctium minus* (Hill) Bernh. Common burdock. B 1210. Common along S edge. Flowering July–August.
- Aster cordifolius* L. B 1209; T 12, 24. Scattered in SE corner of woods. Flowering August–October.
- A. lateriflorus* (L.) Britton. Calico aster. B 1171. In rich S-central woods, apparently uncommon. Flowering July–October.
- A. lowrieianus* Porter. T 6. Apparently rare, in SE corner. Flowering August–October.
- A. macrophyllus* L. Large-leaved aster. B 1149, 1174, 1181; F 146, 157; T 4. Scattered through drier parts of woods. Flowering August–October.
- A. novae-angliae* L. New England aster. B 1211; S 2117; T 15. Occasional in open places near edges. Flowering August–October.
- A. ontarionis* Wieg. Thomas 5. Apparently rare, along E edge. Flowering September–October.
- A. pilosus* Willd. B 1205; S 803, 2124, 2126; T 13. Common weed in disturbed places. Flowering August–October.
- A. simplex* Willd. S 2123. A few patches along W half of S edge. Flowering August–October.
- A. umbellatus* Miller. B 1088, 1168, 1204; S 2109. Common along S edge. Flowering July–September.

- Bidens frondosa* L. Beggar-ticks. B 1193; F 236. Occasional around ponds. Flowering July–October.
- B. tripartita* L. Beggar-ticks. B 1178; S 2136. Occasional in muck of drying ponds, W woods. Flowering August–September.
- B. vulgata* Greene. Beggar-ticks. S 2113. Weedy in wet places along S edge. Flowering August–September.
- Centaurea maculosa* Lam. B 1208; T 44. Common weed along S edge. Flowering July–October.
- Cichorium intybus* L. Common chickory. T 42. Occasional weed around edges. Flowering June–October.
- Cirsium vulgare* (Savi) Tenore. Bull thistle. T 29. Occasional weed in logging disturbances in NE woods. Flowering July–October.
- Conyza canadensis* (L.) Cronquist. Horseweed. S 2130. Weed along S edge, uncommon. Flowering August–September.
- Erechtites hieracifolia* (L.) Raf. Fireweed. B 1170. Weedy in NW corner. Flowering August–September.
- Erigeron annuus* (L.) Pers. Daisy-fleabane. B 1046, 1047; S 1606; T 10. Weedy in disturbed places. Flowering June–October.
- E. philadelphicus* L. Fleabane. B 1020; F 127. Uncommon weed within woods. Flowering May–June.
- Eupatorium perfoliatum* L. Boneset. B 1161; S 2119. Relatively common in wet places along S edge. Flowering August–September.
- E. purpureum* L. Joe-Pye-weed. B 1126; F 86, 141. In wet places in central woods. Flowering July–September.
- E. rugosum* Houtt. White snakeroot. B 1062, 1169, 1179; F 226; T 14. Common, scattered through woods. Flowering July–October.
- Helianthus decapetalus* L. B 1078, 1132; F 111, 123, 145. Locally common. Flowering July–September.
- H. giganteus* L. S 2110. Uncommon, E end of S edge. Flowering July–September.
- Polymnia canadensis* L. Leafcup. Anderson 2180; F 82; S 1605. Common along drainage ditch in S woods. Flowering May–October.
- Prenanthes altissima* L. Rattlesnake-root. Anderson 2177, 2178; B 1162, 1183; F 21. Scattered through woods, especially where sandy. Flowering July–October.
- Rudbeckia hirta* L. Black-eyed Susan. B 1066. One group of plants near S end of drainage ditch in S woods. Flowering June–October.
- Senecio aureus* L. Golden ragwort. S 1081B. In rich S-central woods, rare. Flowering May–June.
- Solidago caesia* L. Blue-stem goldenrod. B 1175, 1206; F 218; Gillis 2847; S 809, 2129; T 16. Common throughout woods. Flowering August–October.
- S. canadensis* L. Goldenrod. B 1158; S 2127. Occasional around edges. Flowering July–October.
- S. flexicaulis* L. Goldenrod. B 1173; S 2104. In S woods, uncommon. Flowering July–September.
- S. gigantea* Aiton. Goldenrod. B 1085, 1153; F 221. Occasional around edges. Flowering August–September.
- S. graminifolia* (L.) Salisb. Goldenrod. S 2128. Occasional along S edge. Flowering July–September.
- Sonchus arvensis* L. Sow-thistle. B 1112; S 1602. Occasional weed on edges. Flowering July–October.
- Taraxacum officinale* Weber. Dandelion. S 865; T 35. Weed along edges and trails. Flowering April–October.

LILIOPSIDA
ALISMATIDAE

ALISMATACEAE

- Alisma plantago-aquatica* L. Water-plantain. B 1064. Scattered in wet places along S edge. Flowering July–August.

COMMELINIDAE

JUNCACEAE

- Juncus ?canadensis* La Harpe. B 1080. In wet places along S edge; the only specimen is too young for positive identification. Flowering July–August.
J. dudleyi Wieg. S 1562. Locally common in wet places along S edge. Flowering June–August.
Luzula acuminata Raf. Wood rush. S 275, 880. Scattered through drier parts of woods. Flowering April–May.

CYPERACEAE

- Carex aurea* Nutt. S 1564. Locally common in open wet places along S edge. Flowering May–June.
C. blanda Dewey. S 332, 868, 903, 915, 1674. Scattered through woods. Flowering May–June.
C. cephaloidea (Dewey) Dewey. S 973. In central woods, apparently rare. Flowering May–June.
C. cephalophora Willd. S 916. Along trail near W entrance, apparently rare. Flowering May–July.
C. convoluta Mack. B 1095; S 972. Central woods, in wet places. Flowering May–July.
C. gracillima Schw. B 1096; S 1075. Scattered in woods. Flowering May–June.
C. intumescens Rudge. B 1052; S 974, 1085C. In central and S-central woods. Flowering May–July.
C. pensylvanica Lam. S 854. In sandy places in W woods. Flowering April–June.
C. rosea Willd. S 832, 874. Scattered but not common. Flowering May–June.
C. sprengelii Sprengel. S 867, 879. In S woods. Flowering April–June.
C. tenera Dewey. S 910. Along drainage ditch in NW woods. Flowering May–June.
C. vulpinoidea Michaux. S 1563B. In wet places along S edge. Flowering June–July.
C. woodii Dewey. Disosway 37; S 280. In central woods. Flowering April–May.
Eleocharis obtusa (Willd.) Schultes. Spike-rush B 1121. One small group of plants on a log in SW pond. Flowering July–September.
Scirpus atrovirens Willd. Bulrush. B 1163; S 1563A. Occasional in wet places along S edge. Flowering June–July.
S. pendulus Muhl. Bulrush. B 1089, 1164; S 1578. Common in wet places along S edge. Flowering June–July.

POACEAE

- Agrostis gigantea* Roth. Redtop. B 1115; S 1601. Occasional along N and E edges. Flowering July–August.
Arrhenatherum elatius (L.) Presl. Tall oatgrass S 1560. Scattered along S side in 1972 but not noticed since. Flowering June–July.
Brachyelytrum erectum (Roth) Beauv. var. *erectum*. B. 1043; F 128, 210, 227; S 1630B. Scattered through woods. Flowering June–July.
Bromus inermis Leysser. Smooth brome. B 1159; S 1576. Common along E edge. Flowering June–July.
B. latiglumis (Shear) Hitchc. S 968. Central woods, apparently rare. Flowering June–August.
B. pubescens Willd. Canada brome. F 88 [f. *glabriflorus* (Wieg.) E. Voss]; S 2100. In S woods, uncommon. Flowering June–September.
Calamagrostis canadensis (Michaux) Beauv. Blue-joint. B 1068. In wet places along S edge. Flowering July–August.
Cinna arundinacea L. Wood reedgrass. F 166. Central woods, apparently rare. Flowering in August.
Dactylis glomerata L. Orchard grass. B 1057. Common along path near main W entrance. Flowering June–August.
Digitaria sanguinalis (L.) Scop. Crab grass. S 2142. Weedy along E edge. Flowering July–October.

- Echinochloa crusgalli* (L.) Beauv. Barnyard grass. B 1148, 1155. Common in low wet area NW corner. Flowering July–September.
- E. muricata* (Beauv.) Fern. B 1150, 1190. Common in low wet area of NW corner. Flowering August–September.
- Elymus villosus* Willd. Wild-rye. S 1603A. Uncommon, in S woods. Flowering July–August.
- E. virginicus* L. Wild-rye. S 2111. Scattered in woods near S edge. Flowering July–August.
- Festuca obtusa* Biehler. Nodding fescue. S 1081A. Uncommon, in S woods. Flowering June–July.
- Glyceria septentrionalis* Hitchc. Manna grass. Anderson 2172. In muck around a pond, probably in W woods; not seen recently and perhaps no longer present. Flowering June–August.
- G. striata* (Lam.) Hitchc. Fowl manna grass. B 1093; F 87; S 975, 1624. Common throughout woods. Flowering June–July.
- Hystrix patula* Moench. Bottlebrush grass. F 54A; S 951. Common in drier places. Flowering June–July.
- Leersia virginica* Willd. White grass. Anderson 2170; F 209. Uncommon, in W woods. Flowering August–September.
- Lolium perenne* L. Ryegrass. S 1557. Common weed along E edge. Flowering June–August.
- Milium effusum* L. S 873. Occasional in rich S-central woods. Flowering May–June.
- Muhlenbergia mexicana* (L.) Trin. S 2116. Along S edge of woods, uncommon. Flowering August–October.
- M. schreberi* J. F. Gmelin. Nimbleweed. S 2144. Uncommon weed along E edge. Flowering August–September.
- Panicum capillare* L. Witch grass. S 2106. Uncommon weed along S edge. Flowering July–September.
- P. implicatum* Britton. S 1575. Occasional in wet places along S edge. Flowering June–August.
- P. latifolium* L. S 1561. In SE corner, uncommon. Flowering June–August.
- Phalaris arundinacea* L. Reed canary grass. B 1044, 1226. Common in wet places along S edge and in NW corner. Flowering May–July.
- Phleum pratense* L. Timothy. S 952, 1577. Occasional weed around edges. Flowering June–August.
- Poa alsodes* Gray. Disosway 38; S 862. Uncommon, along E trail. Flowering May–June.
- P. annua* L. Annual bluegrass. S 908. Occasional weed along N edge. Flowering May–October.
- P. pratensis* L. Kentucky bluegrass. S 904, 917. Occasional along edges and trails. Flowering June–August.
- Secale cereale* L. Rye. S 1556. Adventive along E edge adjacent to fields. Flowering in June.
- Setaria glauca* (L.) Beauv. Yellow foxtail. B 1191. Occasional weed along E edges. Flowering July–September.

TYPHACEAE

- Typha angustifolia* L. Narrow-leaved cat-tail. S 1581. In NW pond; mostly disappeared since road construction altered drainage. Flowering June–July.
- T. latifolia* L. Common cat-tail. S 1580. Sparse in ponds adjoining W edge; common in NW pond before road construction. Flowering June–July.

ARECIDAE

ARACEAE

- Arisaema triphyllum* (L.) Schott. Jack-in-the-pulpit. B 1009; F 45; S 294, 349. Scattered through woods. Flowering April–June.
- Calla palustris* L. Wild calla. S 1076. Thriving in SW pond and partially covering it. Flowering May–August.

LEMNACEAE

Lemna minor L. Duckweed. B 1197. Abundant on W ponds. Flowering June–August.

LILIIDAE

LILIACEAE

Allium tricoccum Aiton. Wild leek. S 292, 1614. Locally common in S woods, forming large patches. Flowering July–August.

Asparagus officinalis L. Garden asparagus. S 941. Adventive along E edge. Flowering May–June.

Erythronium americanum Ker. Dogtooth-violet. F 3, 10; Grashoff 47; S 273. Abundant in drier areas. Flowering April–May.

Lilium michiganense Farw. Michigan lily. S 1600. In rich S-central woods, uncommon. Flowering June–July.

Maianthemum canadense Desf. Wild lily-of-the-valley. B 1040; S 347. In S woods, uncommon. Flowering May–June.

Medeola virginiana L. Indian cucumber-root. B 1118. Near SW pond, rare. Flowering May–June.

Polygonatum pubescens (Willd.) Pursh. Solomon-seal. B 1213; F 149, 207A; S 330. Scattered in central woods. Flowering May–June.

Smilacina racemosa (L.) Desf. False spikenard. B 1034; F 14; S 350. Scattered through woods. Flowering May–June.

S. stellata (L.) Desf. False Solomon-seal. S 311. In S-central woods, uncommon. Flowering May–June.

Trillium cernuum L. Nodding trillium. S 314. In S woods, scattered but not common. Flowering May–June.

T. grandiflorum (Michaux) Salisb. Common trillium. Anderson 2242; B 1229; F 12; S 298. Common throughout woods. Flowering April–May.

Uvularia grandiflora Sm. Bellwort. F 2, 53, 135; S 295. Scattered in central and S-central woods. Flowering April–May.

IRIDACEAE

Iris virginica var. *schrevei* (Small) Anderson. Southern blue flag. B 1027; S 1535. In wet places along S edge and in S-central woods, uncommon. Flowering in May.

SMILACACEAE

Smilax ecirrata (Kunth) S. Watson. Carrion-flower. Disosway 13; S 799, 872. Scattered in central and S-central woods. Flowering in May.

S. illinoensis Mangaly. Carrion-flower. Disosway 52; S 328, 875. Scattered in central and S woods. Flowering May–June.

S. tamnoides var. *hispida* (Muhl.) Fern. Bristly greenbrier. F 153. Scattered through drier parts of woods, uncommon. Flowering in June.

DIOSCOREACEAE

Dioscorea villosa L. Wild yam. F 107. Uncommon in S woods. Flowering June–July.

ORCHIDACEAE

Aplectrum hyemale (Willd.) Torrey. Putty-root. B 1148; Miller in 1964. Scattered but uncommon, in central woods. Flowering May–June.

Cypripedium calceolus L. Yellow lady-slipper. F 60; S 870. Three small groups of plants in S woods. Flowering May–June.

Orchis spectabilis L. Showy orchis. S 335. One group of several plants in rich S-central woods. Flowering May–June.

REFERENCES

- Beach, J. H. & W. D. Stevens. 1979a. A study of Baker Woodlot. I. Physical and historical description. *Michigan Bot.* 18:123-136.
- _____ & _____. 1980. A study of Baker Woodlot. II. Description of vegetation. *Mich. Bot.* 19:3-13.
- Beaman, J. H. 1970. A botanical inventory of Sanford Natural Area. II. Checklist of vascular plants. *Mich. Bot.* 9:147-164.
- Conant, H. E. Undated [1930]. A study in phenology and migration as exemplified [sic] in the woody vegetation of Woodlot 17, at Michigan State College. Unpublished manuscript. Beal-Darlington Herbarium files, Mich. State Univ. 28 pp.
- Giles, R. A. 1941. A survey of the indigenous and naturalized, herbaceous flowering plants, exclusive of grasses and sedges, growing within a ten mile radius of the Michigan State College. M. S. Thesis, Mich. State Univ.

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STUDIES ON MICHIGAN AMBROSIA FUNGI

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The ambrosia fungi (Fungi Imperfecti) in this report are associated with wood-boring beetles of the family Scolytidae. Association between ambrosia fungi and beetles is a mutualistic symbiosis. The fungi are transmitted by special ectodermal glands of the beetle called mycangia (Francke-Grossman, 1967). The mycangia are located on adult females in *Trypodendron* and *Xyleborus* and on adult males of *Gnathotrichus*. The mycangia are associated with the sex of beetles initiating the construction of gallery systems in wood. In temperate regions ambrosia beetles infest the xylem cylinder of weakened, dead, or logged trees and propagate their primary symbiotic fungi upon the walls of the gallery system which they excavate. Ambrosia fungi serve as the sole source of nutrient to the beetle larvae. The gallery systems produced by the beetles and the stains produced by the fungi degrade the economic value of the wood.

Batra (1967) summarized information on taxonomy, beetle association, and distribution of ambrosia fungi. He considered a primary ambrosia fungus one that can be isolated regularly from the mycangium of a beetle, observed being consumed by larvae of the beetle, and isolated repeatedly from galleries formed by the beetles. Fungi not isolated from the mycangium and only occasionally isolated from galleries are considered to be auxiliary. The present study reports the collection of *Ambrosiella ferruginea* (Mathiesen-Kaarik) Batra, *A. gnathotrichi* Batra, *A. hartigii* Batra, and *A. sulphurea* Batra in Michigan for the first time. New

fungal-beetle associations of *Ambrosiella ferruginea* with *Trypodendron betulae* Swaine, *Ambrosiella gnathotrichi* with *Gnathotrichus materiarus* Fitch, and *Ambrosiella hartigii* with *Xyleborus sayi* Hopkins and *X. obesus* Leconte were found.

Portions of beetle-infested timber were dissected to remove beetles or fungi from galleries. Mycangia of *Trypodendron* and *Xyleborus* species were removed entirely from female adults by dissecting the beetle in a series of drops of sterile water. The mycangium was separated, rinsed in sterile water, and crushed directly on agar, or its contents were squeezed out onto agar. Fungi were isolated from the coxal mycangia of *Gnathotrichus* males by complete dissection as above or by killing the beetle, placing it on its back, removing the coxa, lifting out the fungal mass with a fine needle, and placing it on agar. Ambrosia fungi were isolated from galleries immediately after splitting the galleries open. Isolations were made primarily from the fungal layer upon which active larvae were feeding. Single and streak inoculations were made upon agar medium from each gallery.

Isolation media employed were 3% malt agar, 0.6% malt extract agar, 3% malt extract and 1% yeast extract agar (YEME agar), and potato dextrose agar. Pure cultures were maintained and described on YEME agar after 3 weeks. Color designations of cultures of YEME agar follow Ridgway (1912). (Cultures and dried specimens of isolates are maintained in the laboratory of the senior author.)



Fig. 1. Gallery of *Xyleborus obesus* with beetle larvae feeding upon *Ambrosiella hartigii* lining the tunnel walls, $\times 6$.

Ambrosiella ferruginea (Mathiesen-Kaarik) Batra

In Culture on YEME Agar: Growth 9–12 mm/day; colony center effuse, outer half cottony; “Vinaceous Rufus,” “Ferruginous,” “Carob Brown”; reverse diffusing pigment “Ferruginous” to “Carob Brown”; sporodochia dark reddish-brown to black, 1–2 mm in height, abundant in center of fresh isolates; hyphae reddish-brown with age, septate, anastomosing, interwoven, 3.0–10.0 μ in diameter; torulose hyphae budding, septate, thin, smooth-walled; individual cells globose to ellipsoidal, 7.5–10.0 (\bar{x} = 9.6) \times 7.5–9.0 (\bar{x} = 8.5) μ ; sporodochia loose, interwoven, reddish-brown, pseudoparenchymatous at base; conidiophores unbranched, reddish-brown, smooth-walled, 80–150 \times 6–10 μ ; conidia formed in basipetal succession, smooth, thick-walled, reddish-brown with age, solitary or in chains, globose to ellipsoidal, 6.3–10.0 (\bar{x} = 8.0) \times 5.0–9.0 (\bar{x} = 7.2) μ ; odor fruit-like.

Isolations Examined: Associated with *Trypodendron retusum* Leconte from *Populus tremuloides*, 7 mi. SW of Alma, Gratiot Co., 14 VI 1973; *P. tremuloides*, 1 mi. S of Sumner, Gratiot Co., 14 VI 1973; *P. tremuloides*, 3 mi. E of M-66 on Phinney Bridge Rd., Antrim Co., 7 VII 1973; *P. grandidentata*, Alma College Ecological Tract, Montcalm Co., 14 VII 1973 & 20 V 1977; *P. grandidentata*, 2.5 mi. S of Elm Hall, Gratiot Co., 14 VI 1977; *P. grandidentata*, 4 mi. SE of Alma, Gratiot Co., 14 VII 1977. Associated with *Trypodendron betulae* Swaine from *Betula papyrifera*, 5 mi. S of Traverse City, Grand Traverse Co., 18 VI 1973; *B. papyrifera*, 2 mi. SW of Antlers, Marquette Co., 10 VII 1973. Associated with *Trypodendron rufitarsis* Kirby from *Pinus resinosa*, 9 mi. W of Gaylord, Otsego Co., 7 VI 1973.

The association of this fungus as the primary fungal symbiont of the beetle *Trypodendron betulae* represents a new record, though Leech et al. (1940) undoubtedly observed the fungus with this beetle in Minnesota; Batra (1967) assumed association. The collection of *Ambrosiella ferruginea* from *T. rufitarsis* confirms a recent study of this fungal-beetle association in the western U.S. (French & Roeper, 1972a). This fungus appears to be widely distributed and associated with other *Trypodendron* in both North America and Europe (Batra, 1967).

Ambrosiella gnathotrichi Batra

In Culture on YEME Agar: Growth 1–3 mm/day; colony (3 weeks) center raised 3.0–5.0 mm high, cerebriform, slimy, shiny, “Mouse Grey,” sporodochial folds radiating from center to margin of colony; outer third of colony appressed to velvety, “Blackish Mouse Grey,” lacking sporodochia; reverse with sparse intramatrical mycelium, no pigment diffusing into medium irregular cracks beneath colony; mycelium hyaline to yellowish brown, anastomosing, 2.5–5.0 μ in diameter; sporodochia composed of compact, fasciculated hyphae which often coil and twist about each other, 3–5 mm in height; conidiophores hyaline at apex, yellow-brown below, torulose or hyphal, branched or unbranched, individual conidiophores twisting and coiling about center of fasciculate sterile hyphae, 40–165 \times 2.0–3.0 μ ; conidia hyaline, smooth-walled, globose to turbinate with a truncated scar, 5.2–11.0 (\bar{x} = 7.8) \times 3.0–5.5 (\bar{x} = 3.5) μ ;

sprout cells thin-walled, irregular-shaped, borne in chains from conidia in situ, $6.5\text{--}9.0$ ($\bar{x} = 8.2$) \times $6.0\text{--}8.0$ ($\bar{x} = 7.0$) μ ; aleuriospores thick-walled, solitary, $5.0\text{--}9.2 \times 4.0\text{--}7.5 \mu$; odor fruit-like.

Isolations Examined: Associated with *Gnathotrichus materiarus* Fitch from *Pinus resinosa*, Arcadia Township, Gratiot Co., 7 VI 1973; *P. resinosa*, $\frac{1}{2}$ mi. W of Sidney, Montcalm Co., 17 VI 1973.

Batra (1967) recorded this fungus in association with the western beetle *Gnathotrichus retusus* Leconte. This collection of *Ambrosiella gnathotrichi* as the primary symbiotic fungus of *Gnathotrichus materiarus* provides new record of a beetle association for this fungus. Batra (1967) recorded the fungi associated with *G. materiarus* in Pennsylvania and also reported *Endomycopsis fasciculata* Batra and *Cephaloascus fragans* Hanawa as associates but did not record *Ambrosiella gnathotrichi*. *Endomycopsis fasciculata* and *Cephaloascus fragans* were not isolated in our study and should therefore be considered as auxiliary ambrosia fungi of *Gnathotrichus materiarus*.

Ambrosiella hartigii Batra

In Culture on YEME Agar: Growth 14.5–16.5 mm/day; colony (3 weeks) cottony, with small droplets of brownish pigment, “Fuscous” to “Olivaceous Black (1),” after repeated transfer “Natal Brown” to “Bone Brown”; reverse with slight intra-matrical mycelium with diffusing pigment, “Blackish Brown” to black; hyphae septate, anastomose-branched, hyaline to brownish, $3.0\text{--}7.5 \mu$ in diameter; torulose hyphae hyaline to subhyaline, smooth, thin-walled, individual cells globose to ellipsoidal, rarely clavate, $7.0\text{--}11.0$ ($\bar{x} = 9.7$) \times $4.0\text{--}8.0$ ($\bar{x} = 6.3$) μ ; sporodochia rare, where present the base composed of interwoven dark-brown hyphae and torulose hyphae; conidiophores torulose hyphae or hyphal, unbranched, 2–6 cells, $10\text{--}50 \times 6.0\text{--}8.5 \mu$; conidia formed in basipetal succession, smooth, thick-walled, hyaline to subhyaline, globose to ellipsoidal, $8.0\text{--}13.5$ ($\bar{x} = 10.4$) \times $6\text{--}12$ ($\bar{x} = 7.8$) μ ; odor of ripened apples.

Isolations Examined: Associated with *Xyleborus sayi* Hopkins from *Acer rubrum*, 1 mi. N of Torch Lake, Antrim Co., 1 VII 1973; *A. rubrum*, 2 mi. W of Clam Lake, Antrim Co., 7 VII 1973; *A. rubrum*, 2 mi. E of M-66 on Phinney Bridge Rd., Antrim Co., 7 VII 1973; *A. rubrum*, Alma Ecological Tract, Montcalm Co., 10 VII 1973; *A. rubrum*, 1 mi. S of Cedar Lake, Gladwin Co., 28 VI 1973; *A. saccharum*., 5 mi. W of Gould City, Schoolcraft Co., 20 VII 1973; *A. saccharinum*, 3 mi. S of Elm Hall, Gratiot Co., 5 VI 1977; *Quercus rubra*, 2 mi. S of Elm Hall, Gratiot Co., 25 VI 1977. Associated with *Xyleborus obesus* Leconte from *A. rubrum*, 1 mi. N of Torch Lake, Antrim Co., 2 VII 1973; *A. rubrum*, 2 mi. W of Clam Lake, Antrim Co., 7 VII 1973; *P. grandidentata*, 1.5 mi. E of Sumner, Gratiot Co., 20 VII 1973; *A. saccharum*, 5 mi. SW of Alma, Gratiot Co., 20 VIII 1975.

The associations of this fungus as the primary fungal symbiont with *Xyleborus sayi* and *Xyleborus obesus* represent new records. Previously the fungus had been associated with a closely related beetle *Xyleborus*

dispar F. in Germany (Batra, 1967) and the western U.S. (French & Roeper, 1972b).

Ambrosiella sulphurea Batra

In Culture on YEME Agar: Growth 14.0–16.5 mm/day; colony (3 weeks) with superficial mycelium, cottony to densely effuse, “Amber Yellow” to “Old Gold”; reverse with diffusing pigment, “Chaetura Black”; mounds of effuse sterile mycelia 1–3 cm in diameter, 0.5–1.0 cm high; sporodochia consisting of conidiophores with mass of conidia, borne on a mat of interwoven hyphae, black, 1–2 mm in diameter, 1 mm high; conidiophores determinate, hyaline to yellowish-brown, septate, 4.0–7.0 μ in diameter; conidia blastosporic, hyaline to slightly yellowish, thick-walled, slightly truncated, globose to subglobose, 5.0–12.0 (\bar{x} = 7.3) μ ; odor sweet.

Isolations Examined: Associated with *Xyleborus saxeseni* Ratzeb. from *Prunus serotina*, Arcadia Township, Gratiot Co., 12 VI 1973; *P. avium*, 2 mi. N of Vestaburg, Montcalm Co., 15 VI 1973; *Acer saccharinum*, Arcadia Township, Gratiot Co., 25 VIII 1975 & 25 IX 1976.

This association with *Xyleborus saxeseni* was recorded previously from Pennsylvania, North Carolina, Kansas, and Germany (Batra, 1967).

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LITERATURE CITED

- Batra, L. R. 1967. Ambrosia fungi: a taxonomic revision and nutrition studies of some species. *Mycologia* 59:976–1017.
- Francke-Grossman, H. 1967. Ecotosymbiosis in wood-inhabiting insects. Pp. 141–205 in S. M. Henry, *Symbiosis*. Vol. 2. Academic Press, New York.
- French, J. R. J. & R. A. Roeper. 1972a. Observations on *Trypodendron rufitarsis* and its primary symbiotic fungus, *Ambrosiella ferruginea*. *Ann. Entomol. Soc. Amer.* 65:282.
- . 1972b. In vitro culture of the ambrosia beetle *Xyleborus dispar* (Coleoptera: Scolytidae) with its symbiotic fungus, *Ambrosiella hartigii*. *Ibid.* 61:1473–1475.
- Leech, J. G., A. S. Hodson, J. P. Chilton & C. Christensen. 1940. Observations on two ambrosia beetles and their associated fungi. *Phytopath.* 30:227–231.
- Ridgway, R. 1912. *Color standards and color nomenclature*. Washington, D.C.

Publications of Interest

AQUATIC PLANT PROBLEMS IN RECREATIONAL LAKES OF SOUTHERN MICHIGAN. By Clarence D. McNabb, Jr. Michigan State University Cooperative Extension Service Bull. E-115. 1977. 25 pp. \$2.00. Copiously illustrated in color as well as black and white, this bulletin deals primarily with nuisance "weeds" of lakes and ponds, including identification, control, and nutrient relations.

NATIVE HARVESTS. Recipes and Botanicals of the American Indian. By Barrie Kavasch. Vintage Books (Random House), New York. 1979. 202 pp. \$5.95 (paper); \$10.00 (hardcover). This is an ample and fascinating collection of recipes, chiefly from New England tribes although there is occasional reference to others across the continent. Those interested in "living off the land" on a diet low in calories and salt can learn of such delicacies as trout stew, buttered beech leaves, Phragmites gruel (with wintergreen berries), or roasted rhizomes of bracken. There are sections on smokes, beverages, medicines, and gums, as well as fish, game, mushrooms, and seafood, in addition to various native vegetable products. American Indians were apparently very opportunistic in adapting for their own use the common Eurasian weeds as they became established in North America. For it is surprising how many such plants (not to mention exotic seasonings) are included in "authentic" Indian recipes! Pineapple-weed did not reach the eastern states until about a century ago, long after one would have thought that authentic Indian beverages had been established in the area. Botanists may smile at the author's frequent naivete in use of the words and jargon of their trade, as well as the wild mixture of nouns, adjectives, and verbs employed in the glossary and the considerable sloppiness in the bibliography, but such points do not affect the value of this very extensive document on the imaginative cuisine of native Americans. "*Sassafras albidum* and spp." on p. 165 is meaningless, for there is only the one species in all of North America. May-apple is mentioned only as a medicinal and poisonous plant and not for its delicious ripe fruits. Indian-hemp is said on p. 175 to be "highly poisonous" and "definitely inedible" but on p. 170 its "milky, sticky latex" is cited as a chewing gum. None of the plants listed under "Mosses" is actually a moss. The book is not for botanists, but for those with access to the wild plants and other ingredients required for hearty and flavorful dishes, whether "½ cup phragmites seeds," "½ pound dried bear meat," or "1 large raccoon." This is a revised edition of a work originally published in 1977 by the American Indian Archaeological Institute.

HOW TO KNOW THE GILLED MUSHROOMS. By Alexander H. Smith, Helen V. Smith & Nancy S. Weber. Wm. C. Brown Co., Dubuque. 1979. 335 pp. \$6.95 (wire); \$8.95 (hardcover). The authors' wide following of mycologists and mycophagists will welcome this volume, companion to the one on nongilled fleshy fungi, noted in this journal in 1974 (Vol. 13, p. 45). The introductory material includes a full section on edibility and toxicity of mushrooms. The key is illustrated with charcoal drawings, paler than those for the nongilled fungi. The scope is transcontinental, but many of the species are said to occur in the Great Lakes region. A few special keys at the end are designed to guide beginners to genera using macroscopic characters only.

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A RE-INTERPRETATION OF *HYDNELLUM PIPERATUM*
AND *H. HUMIDUM*

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The problem of studying hydnums is their rarity and the difficulty in obtaining adequate material for understanding their inherent variability under various regional and environmental conditions. A very fine collection of Michigan hydnums gathered over many years by A. H. Smith and others is available for study in the University of Michigan Herbarium, and this presentation is to correct the identity of a *Hydnum* recognized by the author in an article published in the *Michigan Botanist* in 1968 and to deal with attempts to recognize *Hydnum humidum*, which Banker described in 1902 from a specimen found at Bar Harbor, Maine, in the fall of 1901. No further material was obtained from Maine, but in 1906 Banker redescribed the species with "supplementary" information from the Ellis' collections from New Jersey that he identified as the same species which he changed to the genus *Hydnum*.

Coker (1919) was the next to recognize *Hydnum humidum*, from North Carolina. His herbarium at Chapel Hill contains collections dated as late as 1934. Coker (1939) described *Sarcodon piperatus* without a validating Latin description, based on a collection made in 1937. The North Carolina collections of the two species were recorded by Coker & Beers (1951). The record of *Hydnum humidum* is supported by three collections and *Sarcodon piperatus* by 16 collections made between 1937 and 1943. There is no evidence that *H. humidum* was collected after *Sarcodon piperatus* was described. Maas Geesteranus (1963) published the Latin description that validated Coker's taxon (as *Hydnum piperatum*). Harrison (1968) reported on collections made by A. H. Smith in Michigan as *Hydnum humidum*.

In 1971 I had the good fortune to collect in and around Highlands, North Carolina, and the Great Smoky Mountain National Park during a season when hydnums were abundant. I obtained 16 collections of *Hydnum piperatum* (Coker) Maas G. but on examining *Hydnum humidum* in the Coker herbarium found them to be the same species (old material is not always acid). In turn the four Ellis' collections from New Jersey were found to be the same as the Coker species.

Through the kindness of C. T. Rogerson, the type collection of *Hydnum humidum* was obtained from the New York Botanical Garden. As mentioned by Banker (1906), it is mouldy and in poor condition. It was impossible to determine what species it really is. It could be established, however, that it is not *Hydnum piperatum* because of evidence of a

spongiose layer on the stipe. The few spores available were not distinctive. The name *Hydnum humidum* is reported here as a *nomen confusum* because of the condition of the type. The type most closely resembles an old, partly decayed, and mouldy sporophore of *Hydnellum caeruleum* (Hornem. ex Pers.) Karst., a common species in Nova Scotia and Maine well known to the author, who has seen it in a similar condition many times during wet fall weather.

***Hydnum humidipes* nom. nov.**

Hydnellum piperatum Coker ex Maas G., Persoonia 2:476. 1963.

Sarcodon piperatus Coker, J. Elisha Mitchell Sci. Soc. 55:373. 1939, *nom. nud.*

Hydnum piperatum (Coker) Pouz., Česká Mykol. 10:68. 1956. *nom. nud.*, not *H. piperatum* (Banker) Sacc. & Trott. in Sacc., Syll. Fung. 21. 1912, not *H. humidum* Banker in White, Bull. Torrey Bot. Club 29:553. 1902, *nom. confus.*

Hydnellum humidum (Banker) Banker, Mem. Torrey Bot. Club 12:162. 1906, *pro parte, sensu* Harrison, Mich. Bot. 7:223. 1968.

Pileus 3–15 cm broad when fused, compound, very irregular, convex, depressed, often imbricate, surface tomentose when young, becoming rough and occasionally scrobiculate, with radiating fibrous ridges and roughenings that stain brownish, margin thick, 0.8 cm, becoming thin and lobed, tomentose to matted, sterile, center Saccardo's Umber, Tawny-Olive to whitish, Light Buff, Pinkish Cinnamon to Drab on margin, occasionally zonate, markedly so in wet weather. Context variable in thickness, up to 12 zones, cheesy to brittle, moist when fresh, Avellaneous, Clay Color, Cinnamon-Buff. Odor farinaceous and taste ranging from farinaceous to slowly acid. Acrid taste slight and only slowly so in throat in some old specimens.

Spines 2–4(6) mm long, decurrent, close, fine, ends blunt, often fused at base to form ridges, 2–3 per mm with short ones between, Verona Brown, Warm Sepia, Wood Brown at some angles, Bister direct view, tips lighter in shade. In Coker 10687, the fusion of the spines forms a maze of plates that is nearly poroid in places. This condition has been noted previously in at least 10 species of hydnums.

Stipe 4–7 × 1–1.5 cm, very irregular, eccentric, complexly fused, often with adhering debris, finely tomentose, apex scabrous from aborted spines, concolorous, with occasional velvety patches Sayal Brown to Snuff Brown near apex, surface with scattered pits filled with drops of watery juice in humid weather, pits rarely showing in dried specimens, base of stipe darker with traces of hyphal mat around some. Context moist, juicy when cut, dark brown to Bister in base, lighter upward to same color as in pileus, dark maggot tunnels often filled with white mycelium, when freshly picked broken stipe surfaces exuding sweet watery juice.

Chemical reactions. KOH slight darkening to an Olivaceous Black

on surface, the context darkening slightly and spines brownish black; FeSO_4 olive to blackish on surface and spines grayish, no reaction on context. No reactions with KOH, Melzer's or FeSO_4 on dried material.

Spores and Hymenium. Spores $4.5\text{--}5.5(6.5) \times 4\text{--}4.5(5.5) \mu\text{m}$, in mass Wood Brown to Buffy Brown, subglobose, colored, finely tuberculate, sometimes truncated, with 8–10 processes on the circumference. Hymenium up to $44 \mu\text{m}$ thick, basidioles $4.5\text{--}8 \mu\text{m}$, basidia $5.6\text{--}8 \times 22\text{--}28 \mu\text{m}$, 4-spored, sterigmata $3\text{--}4 \mu\text{m}$. Small spores pear-shaped, up to $2.8 \mu\text{m}$ wide before surfaces start to roughen.

Tramal characters. Hyphae of spines $3\text{--}4 \mu\text{m}$, flexuous, parallel, cuticular hyphae agglutinated, and not reviving in either KOH or Melzer's, hyphae of pileus mostly $5\text{--}7 \mu\text{m}$, but in layer near dense tissue next to base of spines many cells inflated to $8\text{--}12(14) \mu\text{m}$, oleiferous hyphae up to $12 \mu\text{m}$. Tramal tissues of stipe show an outer layer of interwoven hyphae $2.8\text{--}5 \mu\text{m}$ wide that supports patches of caulobasidia showing hyphal cystidia $3\text{--}4 \mu\text{m}$ wide. Some cells were $28\text{--}50 \mu\text{m}$ long with some "apparent amyloid" particles in one collection. Inner context mostly of parallel hyphae. Clamps not seen on either fresh or revived tissues

Gregarious in oak woods during August and early September in Michigan and North Carolina; Coker reported it from Tennessee and Georgia and also from deciduous woods in New Jersey. In 1971 in Swain County, North Carolina, it was usually found on the crests of sharp ridges with oaks dominant and with occasional pines. MARYLAND, Kauffman 1919; MICHIGAN, A. H. Smith, 8 collections; NEW JERSEY, J. B. Ellis, 4 collections; NORTH CAROLINA, Coker 10683 (type of *Sarcodon piperatus*), 10687 (paratype of same), Beardslee 35084, Harrison 16 collections.

Hydnellum humidum has been confused from the time Banker re-wrote his description to include characters present in Ellis' collections from New Jersey. Coker first recognized the taxon as new because of its acrid taste, as *Sarcodon piperatus*, but failed to provide a Latin description. Pouzar (1956) transferred it to *Hydnum* without validating it and without realizing that an earlier *Hydnum piperatum* (Banker) Sacc. & Trott. existed. Maas Geesteranus (1963) provided a Latin description and transferred the taxon to *Hydnellum*, which is logical when only dried specimens have been seen. However, when numerous fresh specimens were collected in North Carolina, it was realized that Coker's original opinion that this was a fleshy species was correct. Maas Geesteranus' transfer of this species to *Hydnellum* was based largely on the zonate flesh in the dried specimens and apparent in Coker & Beers' (1951) Plate 24. The presence of zones in the flesh has been stressed by Maas Geesteranus as diagnostic for the genus *Hydnellum*, and it is an extremely useful and easily recognized character. However, in *Hydnellum* growth fluctuates with the daily cycles of temperature and humidity, with the result that a series of zones are formed associated with the changes of growth and the deposit of waste products near the advancing margins. Moisture and waste products are exuded by all hydnums, but in the genus *Hydnum* the inflation of the cells is a fundamental character that permits the retention of moisture and prevents zonation. In *Hydnellum* the

species have narrow tubular hyphae throughout the basidiocarps, and these exude drops of liquid during periods of high humidity. In one case it was possible to count 52 zones in the stipe and tramal context of *Hydnellum caeruleum*, and the weather fluctuations for the previous 52 days were recognizable in the zonate pattern of the basidiocarp. *H. humidipes* and the closely related *H. stereosarcinon* (Wehmeyer) K. Harrison (see Harrison, (1968)) form a stirps intermediate between *Hydnum* and *Hydnellum*. Outwardly both species are similar in appearance. In both the tramal hyphae of the pileus are irregularly inflated, with tramal tissues near the surface. Both have thin-walled hyphae that revive so poorly that dried material is difficult to study. Clamps have not been seen, but material is difficult to prepare for a search. Both have a pallid, moist to juicy context. *H. humidipes* exudes a watery juice on the stipe, and *H. stereosarcinon* may even exude it from the surface of the pileus in humid weather. This may be so for both but has not been seen on the former. Zones are present in the flesh and context of both species, although more noticeable in *H. humidipes* than in *H. stereosarcinon*. The tastes and odors are different. The latter is strongly farinaceous, and the former farinaceous with an acrid aftertaste in most collections. The growth variations in the two species are similar, and both have been seen with poroid or daedaloid bands on the margin from fused spines. Both are intermediate in appearing to grow in an indeterminate manner under very humid conditions but are thick-fleshed and thick on the margin when young and when growth conditions are unfavorable. The two cannot be distinguished generically, and while there are characters that connect them to both *Hydnum* and *Hydnellum*, it is felt that the inflated hyphal structure is a basic physical character common to all *Hydnum* species, while zones in *Hydnellum* caused by weather fluctuations are only the normal reaction of active tubular hyphae when growth is checked by a change in humidity.

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LITERATURE CITED

- Banker, H. J. 1902. A historical review of the proposed genera of the Hydnaceae. Bull. Torrey Bot. Club 29:436-448.
- . 1906. A contribution to a revision of the North American Hydnaceae. Mem. Torrey Bot. Club 12:99-194.
- Coker, W. C. 1919. The hydnums of North Carolina. Jour. Elisha Mitch. Sci. Soc. 34:163-197, pls. 1-29.
- . 1939. New or noteworthy Basidiomycetes. Jour. Elisha Mitch. Sci. Soc. 55:373-381, pls. 34-39 & pl. 44(figs. 1-8).
- & A. H. Beers 1951. The Stipitate Hydnums of the Eastern United States. 211 pp., pls. 1-60. Univ. of N. C. Press, Chapel Hill.

- Harrison, K. A. 1968. Studies in the hydnums of Michigan I: Genera *Phellodon*, *Bankera*, *Hydnellum*. Mich. Bot. 7:212-264, fig. 1-25.
- Maas Geesteranus, R. A. 1963. A Correction. *Persoonia* 2:476
- Pouzar, Z. 1956. Příspěvek k poznání našich kloboukatých lesáků. *Česká Mykol.* 10:65-76.
- White, V. S. 1902. Some Mt. Desert Fungi. *Bull. Torrey Bot. Club* 29:550-563.



WISTERIA IN THE GREAT LAKES REGION,

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Wisteria has been known in Michigan in cultivation only until recently. Voss (1977) reported *W. sinensis* as an escape from cultivation in the Douglas Lake region "evidently the first report of wisteria 'going wild' in Michigan." Wray M. Bowden has told me (in personal communication) of Chinese wisterias (*W. sinensis* f. *sinensis*) escaping into wild areas in southern Ontario. Recently, I was apprised of a population of *Wisteria* growing on a floodplain in Cass County, Michigan. This paper concerns that population and the determination of the species. The population was brought to the attention of John H. Beaman, Curator of the Beal-Darlington Herbarium at Michigan State University, by William Westrate of Cassopolis, who found it along McKenzie Street on the floodplain of Dowagiac Creek at T5S, R14W, NE ¼ Sec. 31. At Dr. Beaman's suggestion, I investigated the population during the flowering season (June 17) and again late in the summer (August 14) of 1978 when fruits were nearly ripe. Collections (Gillis 14720, 14894) from these visits have been deposited in ISC and MSC; duplicate material is being distributed to several other herbaria.

Two questions immediately arose: (1) Is this a natural population or one derived from cultivation (escape from cultivation or persistent after cultivation)? (2) What species is it? The first question was more easily resolved than the second.

¹Deceased June 20, 1979.

The habitat is an undisturbed (by man) bottomland along a dirt road. Homesites are widely scattered, the nearest being that of Mr. Westrate about 100 m away on a hill. I am not aware of wisteria cultivated within several miles of the site. Those usually cultivated in Michigan are oriental species. Wyman (1961) states that the American species of *Wisteria* are seldom cultivated in northern gardens as they are "not among the better ornamental types." This statement has been confirmed by observation in southern Michigan during the past two growing seasons.

The plants in question are one of the North American kinds with glabrous pods. The habitat is typical for natural populations of wisteria in Illinois, two Ohio River counties of Ohio and Indiana, and states farther to the southeast. The wisteria is the only apparent interloper in a bottomland woods otherwise typical in species composition for the region. I strongly suspect that this population arrived at the Dowagiac Creek site other than by the agency of man. It is, however, about 300 km from the nearest station for the species (Peoria Co., Illinois), as indicated by herbarium studies.

Determining the species opened a Pandora's box of problems involving the number of *Wisteria* taxa in North America and, if more than one, the relationship of each to the other.

The two supposed species of *Wisteria* native to North America are *W. frutescens* and *W. macrostachys*. Characters usually employed to separate them are number of leaflets, length of inflorescence, presence or absence of glands on the calyx, and ratio of length of calyx tube to lobes. My examination of specimens suggests that there is little correlation of characters traditionally used for separation of species. (Specimens were borrowed from F, ILL. ILLS, IND, ISM, MU, OS.)

In trying to unravel the taxonomic problems in *Wisteria* as he wrote the *Flora of Indiana*, Charles Deam sought assistance from Ernest Palmer, then Research Assistant at the Arnold Arboretum. Palmer's answer is filed in a packet on sheet 78190 at Indiana University (Deam 24918): "While a series of specimens shows that in *W. mac.* the racemes average about twice as long in *W. frut.*, the figures given in the keys mean nothing, as in both species specimens may be found both larger and smaller than the limits given, and in a number of specimens one species overlaps the other in length of the raceme. The same is true to some extent in regard to the length of the calyx tube and teeth and their relative length to each other. As to the glandular character, it is altogether unreliable except that it can be said that on the average *W. macrostachya* is more copiously and conspicuously glandular. In some specimens of *W. frut.* glands are almost or entirely wanting, but you can usually find some if you look closely for them under a low power microscope."

In regard to the length of calyx lobes, authors that mentioned this character indicate that the calyx lobes in *W. frutescens* are shorter than the tube. For *W. macrostachys*, on the other hand, opinions vary from lobes half as long as the tube (Deam, 1940) to lobes nearly as long as the tube (Rehder, 1949), to lowest lobes as long as the tube (Rydberg, 1923), to lobes as long as the tube or the lowest one longer (Small, 1898).

Recently, Bowden (1976, 1977) treated cultivated taxa of *Wisteria* and recognized the two traditional American species.

Duane Isely of Iowa State University, student of the Leguminosae of North America, shared with me a portion of his manuscript dealing with *Wisteria* and gave me permission to extract information published here. He, like myself, has had difficulty in distinguishing *W. frutescens* from *W. macrostachys*. He has seen fit to treat them as a single species, as I do. The characters (mentioned above) which have been used to differentiate two presumed species vary from author to author rather than from population to population. Dr. Isely "is inclined to suspect that there is (or was) an eastern form with shorter inflorescences and more numerous leaflets contrasted with a western or interior type with more ample inflorescences and fewer leaflets" (personal communication). He suggests that further blurring of the ill-defined taxa may be a consequence of disturbance by man and the mobility afforded by cultivation. Accordingly, I treat all native U.S. *Wisteria* as *W. frutescens*. There may be two "forms" of *Wisteria* in eastern United States, but I consider it beyond the scope of this paper to pursue the matter. Having examined specimens from much of the total range of *Wisteria*, I believe that there is no geographic pattern to the variants or any clustering of characters which might make it useful to recognize infraspecific taxa.

Specimens from states bordering the Great Lakes show 9 to 13 leaflets, with an average of 9.94. Inflorescences range from 4 to 20.5 cm, averaging 13.62. Glands are always present on the outside of the calyx but range from scarce to abundant. Both glandular and non-glandular trichomes are present. The Michigan population has 9 leaflets, inflorescences 8–18 cm long, and mixed glandular and non-glandular trichomes on calyces. Figure 1 shows the distribution of *Wisteria frutescens* in states bordering the Great Lakes. (The absence of dots from Missouri, Kentucky, and other states south of the Ohio River should not be interpreted as indicating that the plant does not grow there; it does. Mapping was limited to the area of the Great Lakes.

The synonymy for this species follows:

Wisteria frutescens (L.) Poir. in Lam., Tab. Ency. 3:674. 1823. *Glycine frutescens* L., Sp. Pl. ed. 1:753. 1753. *Anonymos frutescens* (L.) Walt., Fl. Car. 186. 1788. *Apios frutescens* (L.) Pursh, Fl. Am. Sept. 474. 1814. *Thyrsanthus frutescens* (L.) Ell., J. Acad. Phila. 1:371. 1818. *Phaseolus frutescens* (L.) Eaton & Wright, N. Amer. Bot. 354. 1840. *Kraunhia frutescens* (L.) Greene, Pittonia 2:175. 1891 new name (illegitimate when published). *Bradleya frutescens* (L.) Britt., Man. 549. 1901. *Wisteria speciosa* Nutt., Gen. 2:116. 1818. (The generic name is conserved as Nuttall originally spelled it, *Wisteria*, despite the fact that it "honors" a man whose name was spelled Wistar.) *Diplonyx elegans* Raf., Fl. Ludov. 101. 1817. *Thyrsanthus floridana* Croom, Am. J. Sci. 25:75. 1834. *Wisteria frutescens* β *macrostachya* Torr. & Gray, Fl. N. Amer. 1:283. 1838. *Wisteria macrostachya* Nutt. ex Torr. & Gray, Fl. N. Amer. 1:283. 1838, as synonym (invalid). *Wisteria macrostachya* (Torr. & Gray) Robinson & Fernald, Gray's Man. Bot., ed. 7:515:1908. *Kraunhia macrostachys* (Torr. & Gray) Small, Bull. Torrey Bot. Club 25:134. 1898. *Bradleya macrostachys* (Torr. & Gray) Small ex Britt., Man. 549. 1901.

Specimens examined: Illinois: Alexander Co., bottoms of Cache River, at Sandusky, Pepoon & Barrett 543 (ILLS); Clark Co., E of Clark Center, Winterringer 10283 (ISM); Fayette Co., Avena, Harkins (ILL); Fulton Co., near Marbletown, Chase 16020 (ILL);

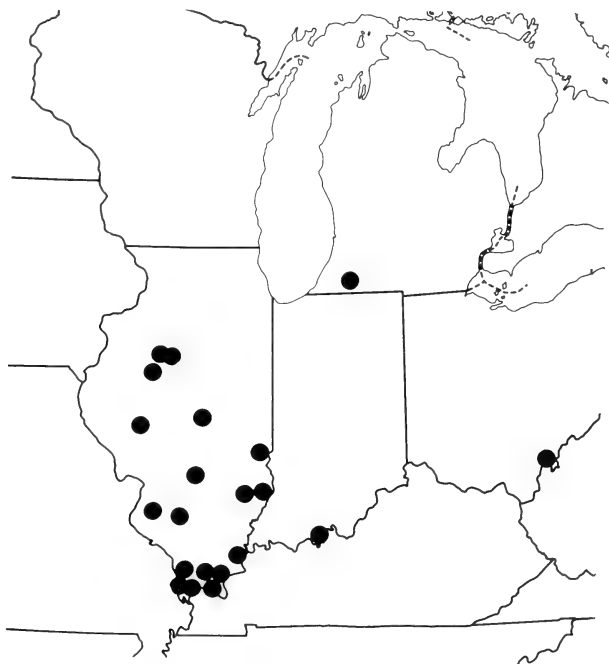


Fig. 1. Distribution of *Wisteria frutescens* in the Great Lakes states. (No attempt was made to map distribution in states farther south.)

Gallatin Co., thickets $\frac{1}{2}$ mi. S of Equality, Ahles 2269 (ILL); Johnson Co., 2 mi. NE of Simpson, near Fire Tower at Simpson Bluff, Fuller 14668 (ISM); Macon Co., Decatur, Smack (ILL); Massac Co., thicket near Mermet, Mermet Lake Conservation area, Winterringer 71863-7 (ISM); Morgan Co., W of Prentice, Rexroat 7737 (ISM); Peoria Co., Peoria Heights, Chase 17270 (ISM, ILLS, ILL, MU); Pope Co., Golconda Road, 2 mi. N of Golconda along river, Schopf (ILL, ISM); Pulaski Co., Cache River bottoms, W of Pulaski, Pepoon & Barrett 1103 (ILL); river bottom woodland, 1 mi. E of Karnak, Ahles 8003 (ILL); 5 mi. N of Grand Chain, cypress swamp, Winterringer 1943 (ILL, ILLS, ISM); Richland Co., 5 mi. N of Olney, roadside thicket, Scherer Shaw 698 (ISM); St. Clair Co., Mascoutah, Welsch (ILL); Union Co., Cache River bottomland, 4 mi. W of Dongola, Pepoon & Barrett 3535 (ILL); Washington Co., Irvington, French (F). Indiana: Perry Co., sandy roadside cut 2.5 mi. N of Tobinsport, Deam 24909 (ILL); wooded ravine along Ohio River near Dodd P.O., 7 mi. above Channelton, Deam 24918 (IND). Ohio: Meigs Co., Salem Twp., Jones (OS).

I acknowledge with appreciation the permission of Duane Isely to quote from his preliminary manuscript on *Wisteria*. The great care and detail of work by Wray M. Bowden presented in a useful exchange of correspondence has given me cause to check and recheck my taxonomic conclusions. Both Drs. Bowden and Isely read the manuscript and made constructive comments. None of this would have happened if it had not been for the inquiry and subsequent co-operation of William Westrate. The curators of the herbaria that lent specimens gave meaningful support to this study. I also acknowledge the efforts of John H. Beaman, who called this matter to my attention and made constructive comments on the manuscript.

LITERATURE CITED

- Bowden, W. M. 1976. A survey of Wisterias in southern Ontario gardens. Tech. Bull. 8, Royal Bot. Gard., Hamilton, Ontario. 15 pp.
- . 1977. The wisterias. Canada Green 1(6):9–11 (plus cover).
- Deam, C. C. 1940. Flora of Indiana. Indianapolis. 1236 pp.
- Rehder, A. 1949. Manual of Cultivated Trees and Shrubs Hardy in North America. Macmillan. New York.
- Rydberg, P. A. 1923. Leguminosae. North Amer. Fl. 24(3), pp. 184–185.
- Small, J. K. 1898. Studies in the botany of the southern United States.—XIII. 1. Species hitherto imperfectly understood. Bull. Torrey Bot. Club 25:134–151.
- Voss, E. G. 1977. Additions and corrections to the list of vascular plants from the Douglas Lake region, Michigan. Mich. Bot. 16:126–141.
- Wyman, D. 1961. Showy Wisteria still a problem vine. Amer. Nurseryman 113:10–11, 68–76.



PETRRHAGIA PROLIFERA, A NATURALIZED SPECIES IN MICHIGAN

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Many species of Caryophyllaceae have been introduced to Michigan, including *Petrorrhagia prolifera* (L.) Ball & Heywood, which has been found in sandy areas of Ottawa and Muskegon Counties and is now naturalized.

Petrorrhagia was revised by Ball & Heywood in 1964. They described 25 species and several varieties, most of which are native to southern Europe and Asia Minor, and discussed the choice of generic name: *Tunica* has been used to encompass most of the species, but Ludwig illegitimately used *Tunica* to replace *Dianthus* L. in 1757, making the usage of *Tunica* by Mertens & Koch in 1831 as a separate genus a later homonym. *Petrorrhagia* was established by Link in 1831, based on *Gypsophila* section *Petrorrhagia*, which had been recognized by Seringe in 1824.

The genus occupies a position between *Dianthus* and *Gypsophila*, with certain characters showing intermediate states between these two genera. *Petrorrhagia prolifera* can be confused with the Deptford Pink, *Dianthus armeria* (see Table 1). Ball & Heywood (1964) indicated that seed structure is the only major character that is constant and reliable for *Petrorrhagia*, aligning the group closer to *Dianthus* than *Gypsophila*. Table 1 lists a summary of characters that I have found useful both in the

TABLE 1: *Petrorhagia prolifera* contrasted with *Dianthus armeria*.

	<i>Petrorhagia prolifera</i>	<i>Dianthus armeria</i>
Habit	annual	annual or biennial
Stem		
pubescence	mostly glabrous	strigose, esp. below nodes
Leaves		
shape	linear	cauline linear, basal narrow-ob lanceolate
base	slightly ciliate	villous
Inflorescence	capitate	open cymose
"Epicalyx" bracts		
number, position	many, enclosing inflorescence	4/flower, few more among infl. branches
texture, color	brown, scarious	green, leaf-like
shape	broadly ovate	linear
tip	2-4 outermost bracts mucronate, inner obtuse	long-tapered to a narrow point
Calyx		
nerves	3/lobe	5/lobe
margin of lobe	glabrous	long-villous
Petals		
color	pink or purplish	pink to red with white spots
veins	1 primary/petal	3 primaries/petal
limb margin	obcordate, bifid	ob lanceolate, toothed
Seeds		
length (average)	1.4-1.7 mm	1.2-1.3 mm
width (average)	0.9-1.1 mm	0.7-0.8 mm

field and in the study of herbarium specimens. (Quantitative data for both species have been gathered from plants collected in Michigan.)

Petrorhagia prolifera (Fig. 1) is a slender annual, 11-57 cm tall, with linear leaves and a capitate inflorescence surrounded by broad, brown scarious bracts. The flowers (Fig. 2) are small, the pink petals opening to a width of about 1 cm. The 4-toothed capsule contains many blackish, reticulate pear-shaped seeds averaging 1.5 mm long by 1 mm wide. The large bracts serve to distinguish *P. prolifera* readily from *Dianthus armeria*, a common species in many sandy areas of Michigan.

Common names for this plant include Childing Pink, Childing Sweet William, and Proliferous Pink. In major floras of eastern North America, *P. prolifera* is most often referred to *Dianthus* or *Tunica*.

Figure 3 summarizes the distribution of *P. prolifera* in Michigan. Specimens examined from Michigan are listed below. Designations of herbaria follow Holmgren & Keuken (1974), except that KBS is used for the herbarium of the Kellogg Biological Station of Michigan State University and WAT for the University of Waterloo.

MUSKEGON CO.: in stony fill just E of Maple Island Rd., 0.35 mi N of Sternberg Rd., T9N, R15W, S23, NW¼, Sullivan Twp., Rabaler 272 (GH, MSC, US, WMU) & 274 (MSC), 28 July 1978; in stony fill along W side of Maple Island Rd., 0.15 mi S of Spaulding Rd., T9N,

MICHIGAN STATE
UNIVERSITY HERBARIUM



Fig. 1. Herbarium specimen of *Petrorhagia prolifera*, collected at Kitchel Dune, Grand Haven, August 8, 1976.

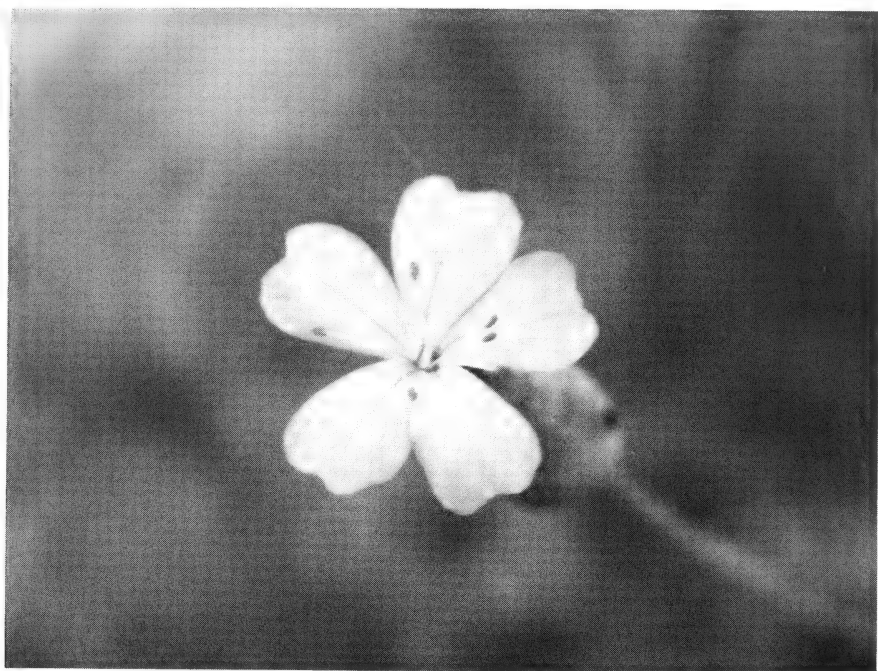


Fig. 2 Flower of *Petrorhagia prolifera*; Kitchel Dune, Grand Haven, June 30, 1978.

R15W, S10, SE¼, Sullivan Twp., Rabeler 304, 29 Aug. 1978 (MO, MSC). OTTAWA CO.: Kitchel Dune on N shore of Grand River opposite Grand Haven, Atwood, Beaman & Rabeler 409, 8 Aug. 1976 (MSC); 10 ft N of Grand River channel wall, 100 yds S of Coast Guard Station, Grand Haven, Crispin 69, 6 Aug. 1977 (MSC); 250–300 m W of North Shore Marina boat house at S edge of Kitchel Dune, Grand Haven, T8N, R16W, S20, SW¼, Rabeler 138, 10 July 1977 (MSC), 154, 30 July 1977 (KBS, MSC), & 245, 30 June 1978 (BLH, EMC, HAM, HCHM, HHH, MSC, WUD); 50 m W of North Shore Marina boat house at S edge of Kitchel Dune, Grand Haven, Rabeler 314, 9 Aug. 1979 (CAN, DAO, GA, HSC, MICH, MSC, NY, SMU, WAT).

P. prolifera appears to be a recent introduction to the flora of Michigan. A search of major herbaria in the United States revealed no other specimens from Michigan, while collections from Cleveland, Ohio, the last made in 1896 (Stair, OS), are the only material seen from any adjoining state. A look at the literature on floristics in Michigan reveals only one reference to *Dianthus prolifer*. Cole (1901) listed it as a garden escape near the Buchanan Street School in Grand Rapids. This is a misidentification, the specimen (Stevenson, 1899, MICH) being in fact *Petrorhagia saxifraga*.

Most of the plants I have seen at Grand Haven grow in open, unshaded areas of sandy to slightly stony roadside fill. These plants are quite fertile, as evidenced by an increase in number and distribution around the marina where we first discovered them. The population is expanding to



Fig. 3. Michigan distribution of *Petrorhagia prolifera*.

fill in open, sandy areas and has invaded a small area of dune sands northwest of the marina. Common associates in this area include *Allium vineale*, *Arabis lyrata*, *Arenaria serpyllifolia*, *Berteroa incana*, *Equisetum hyemale*, *Lepidium campestre*, *Plantago lanceolata*, *Saponaria officinalis*, and *Trifolium arvense*. No evidence of previous cultivation of *P. prolifera* has been found in the area, and the age of the population is not known. Proximity to the marina allows one to speculate on an introduction by land or water travel associated with people visiting the marina.

The two roadside populations in Muskegon County are found in open areas of moderately stony sandfill about 1.2 miles from each other. Specimens collected were fertile with normal seed present. Plants are growing 1 to 6 feet from the edge of the pavement among *Berteroa incana*, *Centaurea maculosa*, *Monarda punctata* and *Pteridium aquilinum*. *Petrorhagia prolifera* appears well adapted to a roadside existence. When the area was visited in late August of 1978, the roadside had been mowed. The *Centaurea* plants had died back, but *P. prolifera* continued flowering from lower branches and was more conspicuous in the absence of *Centaurea*. Just as with the Grand Haven plants, no evidence of cultivation is present, and no estimate of when the plants appeared can be made. Correll & Johnston (1970) suggest that *Petrorhagia* entered Texas in grass seed spread along highway right-of-ways. A similar situation might ex-

plain the origin of this species if seeding did occur along this stretch of highway in Michigan.

I thank Drs. John H. Beaman, Edward G. Voss, and the late William T. Gillis for assistance and criticism during the course of this study. I am indebted to Dr. James S. Pringle, who, through personal communication and his article on *Gypsophila scorzoneriifolia*, provided me with information and ideas on how the data could be assembled. Thanks are also expressed to the curator of OS for the loan of the specimen cited and to the curators of BLH, EMC, HCHM, and MICH for hospitality during visits to their herbaria.

LITERATURE CITED

- Ball, P. W. & V. H. Heywood. 1964. A revision of the genus *Petrorhagia*. Bull. Brit. Mus. (Nat. Hist.), Bot. 3(4):119-172.
- Cole, E. J. 1901. Grand Rapids Flora. A Catalogue of the Flowering Plants and Ferns. A. Van Dort, Grand Rapids, Michigan. 170 pp.
- Correll, D. S. & M. C. Johnston. 1970. Manual of the Vascular Plants of Texas. Texas Research Foundation, Renner, Texas. xv + 1881 pp.
- Holmgren, P. K. & W. Keuken. 1974. Index Herbariorum. Part I: The Herbaria of the World. 6th ed. Regnum Veg. 92:vii + 1-397.

Publication of Interest

THE MUSHROOM TRAILGUIDE. By Phyllis G. Glick. Holt, Rinehart and Winston, New York. 1979. 247 pp. \$5.95 (paper). A comparison of this pocket-sized work with A. H. Smith's Mushroom Hunter's Field Guide is inevitable. This one has a smaller page size, fewer pages, and offers a modest selection of species for the United States and Canada—not especially oriented to the eastern states. It has considerable information on edibility, with some recipes. But it lacks any color illustrations or keys (the lists of characters termed "keys" offer as many as 11 or 12 diagnoses of genera under a single heading, and such "dodecachotomous" choice is no key!). Simple line drawings appear conveniently on the page opposite descriptions of the species. This appears to be a very practical guide, reasonably priced. The index is nearly unique in alphabetizing the species by their epithets, a great help when generic assignments are as variable as they are in the fungi. The rear cover states that this guide was "thoroughly checked by a professional mycologist" who for some reason is not named. One hopes that it was the same excellent one who wrote the brief foreword, Harry Thiers.

A SPECIES OF *LIMACELLA* FROM THE GREENHOUSE

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Numerous fruiting bodies of the [mushroom] *Limacella glioderma* (Fr.) Earle appeared over a four-year period in a ground level planting bed in one of the University of Michigan's Matthaei Botanical Gardens greenhouses. The fruiting was observed in detail during one year. Specimens were first noticed in early December, and fruiting occurred sporadically until the latter part of March. The fruiting bodies, entirely typical of the species, appeared singly, scattered, or more frequently in clusters. The principal higher plant in the bed during the time of fruiting was soybean. (The bed was cultivated in a manner normal for soybeans.) The mushroom normally grows in humus under trees and outdoors in the Ann Arbor area. Its North American range is Nova Scotia south to Florida and west to Washington and Oregon; it grows under hardwoods or conifers, but neither was present in the plant bed where the mushrooms were found fruiting. The fifth year after it was noticed the mushroom ceased to fruit and has not been found in the greenhouse since.



Fig. 1. *Limacella glioderma* ($\times 1$). Photograph by Alexander H. Smith.

The species may be recognized (Fig. 1) by its pileus viscid to slightly granular, medium brown to paler pinkish brown; flesh thick at the disc (thin elsewhere); strongly farinaceous odor and taste; and dry stipe with an evanescent or ragged annulus. Microscopically it is characterized by globose to subglobose spores 3–4 μ m in diameter, inamyloid or some pseudoamyloid; gill trama clearly divergent from a central strand; pleuro- and cheilocystidia lacking; and cuticle of the pileus gelatinous and consisting of long tapering cells.

Publications of Interest

MICHIGAN WILDFLOWERS. By Helen V. Smith. Cranbrook Institute of Science Bull. 42, revised. 1966. 468 pp. \$15.00. Only a note is needed here to observe that the long-awaited new printing of this best-seller is at last available. Various necessary corrections have been made, including those noted in the review in this journal in 1967 (Vol. 6, p. 53); pp. 1–2 on conservation of wildflowers have been completely redone to accommodate the idea of threatened and endangered species; the list of references is slightly altered; the color plates have been converted to much less attractive black-and-white illustrations, to reduce costs; and there is a completely new and very attractive dust jacket. So this is a bit more than a simple reprinting. It will be eagerly welcomed by all those naturalists, teachers, camp counselors, and others who have for several years been deprived of the opportunity to obtain a book so eminently useful in the local area.

As an added note on Cranbrook's botanical publications, it should be mentioned that Bull. 55, *Michigan Flora Part I*, has just been reprinted (price now \$12.50) with minor corrections on only 10 pages as cited on the back of the title page; no other additions or alterations appear in the text, maps, or illustrations, and persons owning the first printing (1972) should not assume that this is a revised edition. It is also welcome news that Bull. 48, *Orchids of the Western Great Lakes Region*, too long out of print, is in process of revision.

PROBLEM PERENNIAL WEEDS OF MICHIGAN. By Robert P. Rice, Jr., Alan R. Putnam, and Ronald H. Lockerman. Michigan State University Cooperative Extension Service Bull. E-791. 1976. 20 pp. \$1.00. A guide to 42 showy or common weeds, fully illustrated with color photos.

OHIO'S NATURAL HERITAGE. Edited by Michael B. Lafferty. Ohio Academy of Science, Columbus. 1979. 324 pp. \$17.95 [plus \$2.00 postage, handling, & tax]. Like many good books these days, this one has had a longer gestation than anticipated, but it has been worth waiting for. In a large-page format, lavishly illustrated with outstanding color as well as drawings and black-and-white photographs, this guide to the natural history of Ohio covers such topics as geological history, original vegetation, climate and weather, forests, waters, prairies, bogs, Lake Erie and its islands, changing land use, and naturalists of the past—by a wide assortment of authors. This is not a guide for identification of kinds of organisms, but a non-technical, beautifully printed exposition of its title.

214 51
**NORTHERN CALCIPHILIC MOSSES IN THE LAWRENCE
LAKE FEN AND MARSH (BARRY CO., MICHIGAN)**

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While Lawrence Lake in Barry County has been most extensively studied, little attention has been given to the bryophyte community. Among the marl deposits in the surrounding fen and marsh, the gently rising slopes and the shallow water with emergent hummocks, an extensive bryophyte cover must surely play a role in the nutrient dynamics of the system. The first step in understanding this role is to determine the nature of the bryophyte flora. Redfearn & Halbert (1969) reported several Lawrence Lake species in a list of species new to the county. The current study located 32 species of mosses and two liverworts, several of which are northern calciphiles not previously known for the lower part of the state.

Lawrence Lake (T1N, R9W, sec. 27) is a marl lake with a littoral and fen pH ranging from 5.6 to 7.8. The pH and high alkalinity are reflected in zones and patches of vegetation surrounding the lake. The bryophyte study was concentrated in the eastern alkaline fen and marsh. All collections were made in habitats where the mosses were submerged or emergent on clumps of sedges, cattails (*Typha latifolia*), or shrubby cinquefoil (*Potentilla fruticosa*).

Scorpidium turgescens (T. Jens.) Loeske, of which I found only a few strands in the Lawrence Lake fen, is a northern species whose range extends into the mountains of Colorado and into the northern lower peninsula of Michigan. The Lawrence Lake location marks a southern range extension of about 200 miles. The only other Michigan collection was made by Steere on Bois Blanc Island, Mackinac Co.

Drepanocladus revolvens is a widespread species, but the Lawrence Lake population clearly belongs to the var. *intermedius* (Lindb.) Wils., which differs by its small size and incrassate, porose walls throughout. It differs from *D. vernicosus* (Hartm.) Warnst., which is also abundant in the littoral zone and previously not reported for southwestern Michigan, by having non-striate, shiny leaves. The two can be distinguished by the larger size, glossy sheen, and golden-brown bases of *D. revolvens* var. *intermedius*. Both occurred in the littoral marsh, but *D. revolvens* var. *intermedius* was more abundant in shallower areas where *Potentilla fruticosa* could be found, and *D. vernicosus* was more abundant in the cattail-sedge zone. While *D. vernicosus* ranges south to Ohio and should be expected in southern Michigan, *D. revolvens* var. *intermedius* is rare in the East and Lawrence Lake marks its southernmost location.

Campylium stellatum is a common calciphile whose occurrence here was expected. However, in addition to typical plants the uncommon var. *protensum* (Brid.) Grout was also present. The plants are smaller and have less crowded leaves which are abruptly acuminate. Although only a few patches were located, they seemed to be distributed as indiscriminately

among the vegetation zones as the typical variety, which occurred as masses on the hummocks of *Potentilla fruticosa* shrubs, strands climbing the bases of *Typha latifolia*, and nearly everywhere a substrate could be found above water. The typical variety was far more abundant than any other moss in the fen or marsh.

Mnium pseudopunctatum Bruch & Schimp, is a calciphile common in wetlands of northern Michigan, but this appears to be the first record of occurrence this far south. It ranges southward to Colorado and the Great Lakes.

I thank Mary Edwards and Ray Tallent for assistance in collecting. Vouchers are in the Michigan Technological University Cryptogamic Herbarium and the author's private collection.

LITERATURE CITED

Redfearn, P. L., & R. L. Halbert. 1969. Mosses from southern Michigan: new distributional records. Mich. Bot. 8:120-130.

Publications of Interest

THE ENDURING GREAT LAKES. Edited by John Rousmaniere. W. W. Norton & Co., New York. 1979. 112 pp. \$12.95. The acknowledgments state that this book "is adapted from an issue of *Natural History*" but do not identify the issue as being the one for August/September 1978 nor state that two chapters have been added to the reprinted articles. The additions are "A New Type of Fishing" by Frank Mainville, on sport fishing in the Great Lakes (especially Michigan) and "The Most Difficult Problem: Toxins and the Lakes" by Dennis Konasewich. The other articles have been rearranged in a somewhat more logical sequence and a very few additions and subtractions have been made to the illustrations, most noticeably omission of the color photo of water arum previously misidentified editorially as arrowhead. Chapters include consideration of changes in algal, flowering plant, and fish populations, fishing, bald eagles, and effects of lakeside power plants.

FLOWERING PLANTS OF THE WORLD. V. H. Heywood, Consultant Editor. Oxford University Press, Oxford. 1978. 336 pp. £7.95. [Distributed in the U. S. by Mayflower Books, New York. \$17.95.] Almost all the families of flowering plants are covered, with information on diagnostic features, distribution, numbers of genera and species, classification (e.g. subfamilies and relations to other families), and economic uses. The copious drawings, often in color, including those with the extensive glossary, are the superb work of three botanical artists, and do much to illuminate the text, which was contributed by over 40 botanists (identified by initials for each family). The overall system is largely that of Cronquist, although his subclasses, while retaining the subclass endings on the names, are termed superorders. The small world distribution maps for the families are often inaccurate by as much as hundreds of miles in northern North America, but nevertheless give a quick picture. My only other complaint is the consistent use of plural subject and singular verb at the beginning of every treatment, e. g. "The Magnoliaceae is . . ."; merely declaring a plural word to be singular, as is done in the introduction, does not make it so nor reduce the harshness to the reader. Attribution of this work is difficult: the "consultant editor" receives top billing on the dust jacket and spine, but there are also an advisory editor, a project editor, a managing editor, a simple "editor," and other named functionaries—besides the contributors, who presumably actually wrote the book! Even before this outstanding volume, fully worth the original price, could be noted here it has for some mysterious and short-sighted reason already been remandered by the publisher; with luck it can still be found for as little as \$6.00 in bookstores handling such books.

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**LEONTODON AND HYPOCHAERIS (COMPOSITAE)
IN WISCONSIN**

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Leontodon and *Hypochaeris* are dandelion-like adventives from Europe, long established in both eastern and western North America but not heretofore reported for Wisconsin as part of the naturalized flora. In flower, the genera (as they occur in Wisconsin) may be readily distinguished by the chaffy receptacle and coarse, branched flowering stem in *Hypochaeris*, the chaff lacking and the delicate flowering stems unbranched in *Leontodon*. Were only the basal rosettes present, the two might be told apart by the strong taproot in *Hypochaeris*, very difficult to dig intact, whereas *Leontodon* has a surficial caudex with many fibrous roots, readily pulled up with one's fingers.

Johnson & Iltis (1963) said nothing of *Hypochaeris*, and of *Leontodon* they discussed only *L. autumnalis* L., based on a single specimen in WIS that they strongly suspected was of garden origin. It may well have been, although Hortus Third (1978) dismissed the entire genus as not cultivated, and Bailey (1949) made no mention of the genus. In any case, no further specimens of that species have come to light from Wisconsin, in so far as collections at WIS, UWM, MIL, and OSH reveal. Since 1963, more records have accumulated, and I can now report the establishment of both genera in Wisconsin.

The original find of *Leontodon taraxacoides* (Vill.) Merat, which may take the common name Hawkbit, was in Iron County—Hurley High School grounds, sect. 24, T46N, R2E, not too plentiful but a pest in some lawns, J. Lindsay 127, 19 July 1974, WIS, MICH, MIL, NY, GH, photocopy OSH. The species was next found in Dane County—Weed in newly seeded lawn, sect 25, Oregon Township, M. Miron 021, 20 July 1979, OSH. This second collection for the state piqued my interest, and I returned to the original Lindsay collection site to find the plant growing most vigorously: Iron County—Very abundant, many hundreds of plants, on W-facing grassy embankment outside the fence at Hurley High School near the corner of Fifth Avenue North and Bernard Street (and spreading onto nearby lawns), Harriman 16217, 15 Sept. 1979, OSH, MICH, WIS, MIL, UWM, OS, etc. Taking advantage of the plant's abundance, I took living plants to grow root tips for chromosome number determinations; they proved to have $2n = 8$, in agreement with all previous reports (Fedorov, 1969; Taylor & Mulligan, 1968). I also found the species about half a mile away in Iron County—In a large cemetery along the E side of US 51, ca. 100 yards N of the S city limits of Hurley and in the lawn

across the street at the Iron County Courthouse and Jail, Harriman 16219, 15 Sept. 1979, OSH, MICH, with duplicates to be distributed. I also searched in adjacent Ironwood, in Gogebic County, Michigan but failed to find the plant there. It must certainly occur in the county, since the plants in Hurley are very fruitful and the Montreal River that forms the state border and the only line between the two confluent cities is a small stream not 20 yards wide.

The binomial adopted here follows the treatment in *Flora Europaea* (Tutin et al., 1976). In the manuals for northeastern North America (Gleason & Cronquist, 1963; Fernald, 1950), the plants will come to *L. leysleri* (Wallr.) G. Beck, a binomial reduced to the synonymy of *L. taraxacoides* in the index of volume 4 of *Flora Europaea*, page 492. The correct name for this plant is in a nomenclatural thicket where I dare not venture (see, e.g., Hitchcock, et al., 1955, page 254). Since the plant is European in origin and the treatment in *Flora Europaea* is a critical, modern one, I adopt the name used there without further comment.

Hypochaeris radicata L. (by some called Cat's Ear) has long been naturalized in North America but was first found in Wisconsin in Waupaca County—weed in lawn in Clintonville, K. D. Rill 2598, 25 Aug. 1970, WIS. Mrs. Rill revisited the site in September 1979 but was unable to find the plant any longer. The second record of its occurrence was in Sauk County—Adjacent to parking for Dell Creek (public hunting and fishing ground), sect. 21, T13N, R5E, K. Lange s.n., 26 July 1974, WIS. I revisited the Sauk County site and found but a single plant. However, less than half a mile away was an extensive population: Sauk County—Open grassy area, SE corner of the junction of county trunks H and P, NE¼ sect. 21, T13N, R5E, Harriman 16159, 11 Aug. 1979, OSH, WIS, MIL, UWM; ASU, OS, etc. The specimens are the voucher for my determination of the chromosome number, $2n = 8$, which agrees with all earlier determinations for the species (Fedorov, 1969; Taylor & Mulligan, 1968).

The most abundant populations of the plant were found in Iron County—along a mowed roadside embankment, W side US 51 at the Star Lite Motel, about 100 yards S of the S city limits of Hurley, sect. 36, T46N, R2E, Harriman 16203, 15 Sept. 1979, OSH, WIS, MIL, UWM, MICH, etc. This population likewise proved to have a chromosome number of $2n = 8$. And, while searching lawns and roadsides in Ironwood, Gogebic County, Michigan for the *Leontodon*, I chanced upon the *Hypochaeris*: very abundant in grassy area at entrance to Norrie Park in Ironwood, at the S city limits, Harriman 16218, 15 Sept. 1979, OS, WIS, MIL, UWM, OSH, etc. The lawn inside the park is infested with many hundreds of these plants. And finally, I found the plant in Oneida County, Wisconsin—a single plant on lawn at junction US 51 and county trunk J, in Minoqua, Harriman 16221, 16 Sept. 1979, OSH. All these records make it clear that the plant is widely established and fully naturalized in the flora of Wisconsin.

In the matter of the spelling of the generic name, Fernald (1950) renders it as *Hypochoeris*, while Gleason & Cronquist (1963), Hitchcock

et al. (1955) and Tutin et al. (1976) have it as *Hypochaeris*. Article 74 of the International Code of Botanical Nomenclature dealt directly with this problem of variant spellings. Linnaeus adopted the *ae* spelling in *Species Plantarum*, ed. 1, May, 1753 and in *Flora Anglica*, 14 April 1754. But in the *Genera Plantarum*, ed. 5, August, 1754, he took up the *oe* spelling. Then in the *Flora Anglica* of 1759 he reverted to the *ae* spelling, and in subsequent editions of the *Species Plantarum*, he consistently used the *ae* spelling (fide E. G. Voss, in lit.), thereby establishing the spelling which he intended and which is adopted here.

LITERATURE CITED

- Bailey Hortorium Staff. 1976. *Hortus Third*. Macmillan, New York. 1290 pp.
- Bailey, L. H. 1949. *Manual of Cultivated Plants*. Rev. ed. Macmillan, New York. 1116 pp.
- Fedorov, A. 1969. *Chromosome Numbers of Flowering Plants*. Academy of Sciences of the USSR. 926 pp.
- Fernald, M. L. 1950. *Gray's Manual of Botany*. 8th ed. American Book Company, New York. 1632 pp.
- Gleason, H. A. & A. Cronquist. 1963. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. Van Nostrand Reinhold, New York. 810 pp.
- Hitchcock, C. L. et al. 1955. *Vascular Plants of the Pacific Northwest*, Part 5: *Compositae*, by Arthur Cronquist. University of Washington Press. 343 pp.
- Johnson, M. F. & H. H. Iltis. 1963. Preliminary Reports of the Flora of Wisconsin No. 48. *Compositae I—Composite Family I (Tribes Eupatorieae, Vernonieae, Cynarieae [sic], and Cichorieae)*. *Trans. Wisconsin Acad. Sci.* 52:255–342.
- Taylor, R. L. & G. A. Mulligan. 1968. *Flora of the Queen Charlotte Islands*. Part 2. Cytological aspects of the vascular plants. Research Branch, Canada Department of Agriculture, Monograph Number 4, part 2. Ottawa, Canada. 148 pp.
- Tutin, T. G. et al. (editors). 1976. *Flora Europaea*, Volume 4. Cambridge University Press. 505 pp.

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*On the cover: cryptochlorophaeic acid from Cladonia
cryptochlorophaea (a pixie cup lichen), extracted in acetone,
crystallized in a mixture of glycerin, alcohol and
water, and photographed under dark-field
illumination by Jeffery W. Holcombe*

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THE

MICHIGAN BOTANIST

May, 1980

**NATURE PRESERVES IN MICHIGAN,
1920-1979**

Susan R. Crispin

Michigan Natural Features Inventory

Published by the Michigan Botanical Club in
cooperation with the Michigan Natural Areas Council

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**NATURE PRESERVES IN MICHIGAN,
 1920-1979**

Susan R. Crispin
Michigan Natural Features Inventory

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I. INTRODUCTION

Nature preserves . . . are not just for rocks and rills, birds, bees and trees. Primarily, they are for people. . . . As cultural assets they are at least as meaningful as zoos and botanical gardens, aquaria and planetaria. They differ in that, once destroyed, they cannot be replaced within a reasonable time span, if at all. Everyone, whether aware of it or not, will continue to benefit from them at least indirectly. The mere existence of a system of small outstanding areas set apart from ordinary commercial exploitation tells something about the sensitivity of our society and its culture. They show that the richest country in the world can afford to recognize that man does not live by economics alone. (Lindsey et al., 1969)

Within the past decade, the importance of natural area preservation has gained national recognition. It is no longer considered a narrow cause, supported only by a handful of professional nature-lovers, but rather is recognized as a vital need by national politicians, eminent biologists, state administrators and professional and amateur naturalists. It has also emerged from the "anti-progress" image often associated with preservation in general, to constitute a rational, reasonable philosophy of natural heritage preservation, which, as Lindsey states, is ultimately a preservation for people.

The specific values of nature preservation have been enumerated by many authors (Leopold, 1949; Lindsey et al., 1969; Ohio & The Nature Conservancy, 1977; Gunter, 1978; Reveal & Broome, 1979). Presented below is a synopsis of these values.

Rationales for nature preservation have been divided into two categories: ecocentric and anthropocentric. Perhaps the only truly ecocentric argument is that every living species has an inherent natural value and a right to compete for survival without human interference and that we, as the dominant species, are responsible for protecting others from unnecessary or inadvertent destruction.

Rationales which are wholly or partly anthropocentric include the following:

Preservation of species in their habitats—

- for their genetic value as potential food, drug, fuel, and chemical producers;
- to discover and study natural survival mechanisms, including forms of communication, underwater breathing, water economy, etc.;
- to discover and study organisms which can monitor environmental pollution.

Preservation of ecosystems—

- as baseline systems from which to monitor the effects of human manipulation on natural systems;

- for the study of natural ecosystem dynamics to help us design efficient, effective artificial systems;
- for the study of natural ecosystem dynamics to help us maintain the balance of nature and avoid self-destruction;
- to discover and study natural biological control mechanisms;
- for the understanding and appreciation by future generations of natural features and the intricate beauty of natural ecosystems;
- to preserve for future generations our nation's outstanding natural diversity;
- to provide a necessary diversity of human environment for ourselves and our children.

Clearly, from a relatively small sacrifice on our parts—the setting aside from “development” of exemplary natural features—we stand to gain considerable benefit.

Presented herein is an inventory of areas in Michigan which have been set aside in this way, explicitly for the long-term protection of the natural features therein. The intended uses of this inventory are twofold. First, it should provide a basis upon which we can assess the adequacy of our preservation efforts thus far—i.e., which natural features and ecosystems have yet to be protected? Second, it should be a working document whereby potential investigators may locate outstanding outdoor laboratories for studies which, in turn, will form a basis for the long-term observation of natural processes in ecosystems free from human alteration.

II. DEFINITION OF NATURE PRESERVE

For the purposes of this study, a “nature preserve” is defined as an area set aside by its owner solely to preserve the natural ecosystem, or unique features thereof, indefinitely in a natural state, for scientific study and/or as a public monument. Areas intended primarily for outdoor education (without special natural area dedication), and those open to manipulative research which manifestly alters the natural ecosystem are excluded from this definition.

Two categories of nature preserves are recognized herein:

- 1) Natural Area Preserve: The natural ecosystem is allowed to maintain itself without human interference. Developments exist only to provide public access and interpretation, and to protect fragile features from visitor damage.
- 2) Managed Preserve: Management is allowed in order to protect and maintain an unusual species, group of species, or biotic community that would not otherwise persist under natural conditions. This does not include areas managed primarily to maintain unnaturally large populations of game animals; i.e., natural features must be preserved for their inherent natural value and not for economic or recreational value.

The difference between a natural area and a nature preserve must be clearly understood at this point. A natural area has been defined as an area "containing an aquatic or terrestrial ecosystem that has essentially retained, or recovered, its primitive conditions, or is a least disturbed known or available example of a type of natural ecosystem" (Natural Areas Association, 1979). This definition functions as a criterion for the selection of areas to be preserved. The present study, however, is concerned only with areas which are already afforded protection. It has therefore been unnecessary to determine whether each would qualify under the definition of a natural area; those decisions, right or wrong, have already been made.

One of the major requirements, then, for a nature preserve is that its protection be reasonably assured for the indefinite future. For areas included in the present study, this has been accomplished in one of the following ways:

- 1) Ownership (or long-term lease) by an organization dedicated to nature preservation;
- 2) deed restriction or similar legally-binding agreement with the owner;
- 3) formal dedication through administrative or legislative process.

Organizations whose mere ownership confers nature preserve status include The Nature Conservancy, Michigan Audubon Society, Michigan Nature Association, and Long Lake Preservation Association. These groups have as a basic (usually primary) philosophy the preservation of nature for scientific study and for inherent natural values. Protection of preserve properties owned by these organizations need not be specifically documented, since organizational charters ensure that all efforts will be directed toward nature study and preservation.

Deed restrictions must be explicit, and generally include reverter clauses which become active if conditions are not met. Another legal means of ensuring preservation by legal agreement is the dedication of private property according to state law, i.e., the Wilderness and Natural Areas Act. In such a case, the management requirements for dedicated areas are legally binding upon the owner. (While no cases of such dedication presently exist, the Act does provide for it as a legitimate means of legal preservation.)

The concept of legal obligation is of primary importance here, since Federal and state governments often designate privately-owned natural areas or landmarks for the purpose of simply recognizing natural values and encouraging preservation. These types of areas—which include National Natural Landmarks, Wild and Scenic Rivers, etc.—are not assured of preservation unless they are owned by the government which so designates them, as there is no legal or administrative recourse, should the private owner fail to comply with suggested use restrictions.

Legislative or administrative dedication of nature preserves includes the broadest variety of preservation mechanisms. Dedications under state and Federal laws, such as Michigan's Wilderness and Natural Areas Act

or the Federal Wilderness Act, comprise the bulk of these preserves. (National Parks, while they include some truly extraordinary examples of natural ecosystems, exist primarily for public recreation, and are developed for such as the Park Service deems necessary.) Additionally, both state and Federal governments designate preserves administratively, as will be detailed in the following chapter. Other administrative units, such as universities, local governments, and nature centers, may also resolve to create preserve property.

In some cases, although a property may be managed as a preserve, no formal statement of intent has been made by the owner or managing agency. This may reflect a desire to maintain other use options or merely a satisfaction with the status quo, which may seem to provide sufficient protection. In either case, the importance of ensuring preservation for the indefinite future is clearly not emphasized by the owner, and these areas are not recognized here as preserves. (Many such areas encountered in this study are included in Appendix E.)

As with most definitions, the one presented herein is subject to a degree of interpretation, and is therefore not foolproof. For example, nature centers are not considered to be nature preserves (unless specifically designated and managed as such by the owner), since their primary purpose is outdoor education. However, Seven Ponds Nature Center, owned and operated by the Michigan Audubon Society, is not only a nature education facility, but also an Audubon Sanctuary. I have therefore made the somewhat subjective decision to include it as a nature preserve.

In order that areas which might deserve inclusion under another's judgment not be wholly neglected, I have included an annotated list of areas with ambiguous status in Appendix E. Also included in that listing are areas with partial or informal protection which need work to assure their long-term preservation.

III. PRESERVATION ORGANIZATIONS

A number of organizations and government agencies have helped establish Michigan's nature preserves. Although they share many goals, the different methods and accomplishments of each merit individual attention.

Michigan Natural Areas Council

The Michigan Natural Areas Council stands apart from all other state preservation organizations in that it does not hold any land. Its activities are rather directed toward the discovery and evaluation of natural areas as potential nature preserves. The Council may ultimately recommend that a landowner "dedicate" his or her property.

The Council originated in 1949 as a committee of the Michigan Botanical Club and became an independent organization in 1951 (Humke,

1970; Thompson, 1976). It was (and still is) composed of professional scientists, knowledgeable amateurs, and avid conservationists. Early work focused on state lands, and dedications resulting from the Council's recommendations included portions of Wilderness State Park, Highland Recreation Area, Tahquamenon Falls State Park, and the Porcupine Mountains.

Several categories of nature preserves have been designated. Natural Area Preserves are to receive maximum protection, with only simple foot trails for access. The construction of interpretive aids is allowed in Nature Study Areas. Scenic sites are intended to protect features of scenic beauty for public enjoyment. Lastly, any or all of the above may be incorporated into a Nature Reservation, together with buffer zones and maintenance facilities. Two additional classes include the Nature Research Area—intended primarily for scientific research and sometimes not open to the public—and the Managed Tract. The latter was created to allow for environmental manipulations necessary to maintain successional plant communities or unusual wildlife species (Thompson, 1976).

Through the Council's efforts, numerous dedications, totalling nearly 100,000 acres, have been made in each category on both public and private lands. Among them are 17,700 acres in the Huron Mountains, 46,246 acres in the Porcupines, 17,184 acres in Tahquamenon Falls State Park, 2029 acres on Bois Blanc Island, and 179 acres in Warren Woods, Berrien County.

Since the enactment of state nature preserve legislation in 1972 (discussed below), the Council's influence on dedication of state lands has been substantially diminished. Dedication is now a lengthy administrative process in which the Council has no special input, with much of its former influence relegated to the Wilderness and Natural Areas Advisory Board. Nonetheless, it continues as an independent scientific advisor and frequently recommends state-owned land for preservation, much of which is eventually dedicated.

State of Michigan

Natural area preservation by Michigan's Department of Natural Resources (DNR) has been strongly influenced by the Michigan Natural Areas Council. In 1950, Percy J. Hoffmaster, then director of the Department of Conservation, called for the assistance of a citizen organization to survey state lands and recommend for possible dedication those areas possessing unusual natural features or scenic sites (Thompson, 1976). The subsequently-formed Council responded with reports on some very choice natural areas. As a consequence of this teamwork between the DNR and the Council, approximately 70,000 acres were dedicated by 1955 in three major state parks (Wilderness, Tahquamenon Falls, and Porcupine Mountains) and the Highland Recreation Area. Numerous smaller dedications followed, so that in 1970, a total of 18 state-owned areas had received nature preserve status by resolution of the Conservation Commission.

In 1972, the scene of nature preservation in Michigan changed significantly with the passage of the Wilderness and Natural Areas Act (Act 241, P.A. 1972). The statute provides for the formal, legal dedication of nature preserves by the state. Under the Act, a Wilderness and Natural Areas Advisory Board, composed of seven citizens of varying backgrounds, recommends to the DNR a potential Wilderness or Natural Area. The DNR then reviews the proposal, after which it is submitted to legislative committee for approval. Finally, the Natural Resources Commission, following a public hearing, makes a final ruling to dedicate the proposed area. Proposals for dedication may also be submitted to the Natural Resources Commission by private citizens. The Act provides for the dedication of both state and private lands. Dedication under this statute represents the strongest legal protection available for nature preserves in Michigan.

The Act defines three preserve categories: Wilderness Areas must be largely undisturbed tracts of at least 3000 acres. Natural Areas must have a natural character or features of special natural value, but need not be undisturbed. Wild Areas are similar to Wilderness Areas but cover fewer than 3000 acres. The Wilderness and Natural Areas Advisory Board has also designated three subtypes within the category of Natural Area; these are Scenic Sites, Nature Study Areas, and Research Natural Areas, adapted from the Michigan Natural Areas Council definitions.

Since the passage of the Act, twelve of those areas previously dedicated by the Natural Resources Commission have been formally rededicated, and three additional sites have been newly dedicated. Of the six tracts not yet rededicated, three are in process and one has been incorporated into Sleeping Bear National Lakeshore. The remaining two (Algonac State Park and Tobico Marsh) require management to maintain important natural features, and although the Act requires that a dedicated area "be maintained or restored so as to preserve its natural values," this has not yet been construed to allow management aimed at perpetuating successional ecosystems or wildlife habitat.

The state is presently initiating a Natural Heritage Program in cooperation with The Nature Conservancy (see p. 217).

The Nature Conservancy

The Nature Conservancy is a national organization committed to the preservation of natural diversity. Its earliest involvement in nature preservation in Michigan was through the Michigan Natural Areas Council, which then served as the official representative of The Nature Conservancy in the state.

More recently, the Conservancy has developed an independent program through field representatives assigned to Michigan. One of its primary functions has been to assist other conservation organizations in land acquisition projects. Not all such acquisitions have become nature preserves, but approximately ten have been accorded protective status, and one has been recommended for Federal Wilderness designation. The

Conservancy also maintains its own system of preserves, presently consisting of twelve tracts acquired through purchase and donation. In addition, six prairie sites adjacent to AMTRAK railroad lines are being leased by the Conservancy to protect and maintain the plant communities therein.

As previously noted, the Conservancy and the DNR are together initiating a Natural Heritage Program.

U.S. Government

The nature preservation activities of the Federal government have been described in detail by The Nature Conservancy in Volume I of *Preserving Our Natural Heritage* (1977). Presented below is a synopsis of the three primary means by which the U.S. government has created nature preserves in Michigan.

National Wildlife Refuges

National Wildlife Refuges represent the Federal government's earliest involvement in nature preservation in the state, with the establishment of Lake St. Clair National Wildlife Refuge in 1934, followed by the 95,455-acre Seney Refuge in 1935. Later designations included Shiawassee, Huron Islands, Michigan Islands, and Wyandotte National Wildlife Refuges.

Although intensive management is carried on in the two major refuges—Seney and Shiawassee—the overriding goal is the preservation of natural diversity, particularly for birds and mammals. In the 1970 Wildlife Refuge Handbook 4, the priority objectives of the Refuge System are stated as follows (U.S. Dep. Interior, 1970):

- 1) To assure the survival in a natural state of each of this Nation's plant and animal species;
- 2) To assure the continued availability of habitat capable of supporting migratory bird populations at desired levels;
- 3) To demonstrate both optimizing and maximizing practices of wildlife and wildlands management, including demonstrations of reconciling wildlife needs with human modifications of traditional habitat;
- 4) To expand understanding and appreciation of wildlife, wildlands ecology, and man's role in his environment

These goals, though certainly desirable, are also extremely diverse, and pose a challenge to successful management. For this reason, numerous studies have been conducted within the last decade to assess the effectiveness of the National Wildlife Refuge System in meeting its goals and to periodically redefine and augment those goals. The most recent of these studies appeared in April, 1979, and is presently being implemented by the Fish and Wildlife Service.

Although management for economic benefit does occur in National Wildlife Refuges, it is allowed only when "demonstrably compatible with Service objectives to preserve, protect and enhance wildlife habitat." Similarly, although wildlife production is a stated goal of many refuges, the Service states that "refuges will not be managed primarily to produce game species, but that sound, scientific wildlife management will produce

populations normally able to sustain reasonable consumptive use" (National Wildlife Refuge Study Task Force, 1979).

Natural Area Designations

Since 1927, Federal land management agencies from the National Park Service to the Air Force have cooperated to develop a system of Research Natural Areas. The two primary goals of the program have been "to preserve a representative array of all significant natural ecosystems and their inherent processes as baseline areas; and to obtain through scientific education and research, information about natural system components, inherent processes, and comparisons with representative manipulated systems" (Federal Committee on Ecological Reserves, 1977).

Informal coordination of these agencies' activities was initiated in 1966 by the Federal Committee on Research Natural Areas. This effort was formalized in 1974 by the National Science Foundation and the Council on Environmental Quality, which formed the Federal Committee on Ecological Reserves. With a membership of seventeen Federal agencies, the Committee has promulgated a charter stating objectives and management policies for Research Natural Areas (Federal Committee on Ecological Reserves, 1977).

In Michigan, eight tracts, comprising 5981 acres, have been designated as Federal Research Natural Areas. (McCormick RNA, covering 3675 acres in Marquette County, is the largest Research Natural Area in the eastern United States.) These areas lie in the National Forests, Seney National Wildlife Refuge, and Isle Royale National Park, and are managed to preserve the natural ecosystems without human interference. Environmental manipulation is allowed only to simulate natural processes (e.g., fire). No permanent improvements such as roads and buildings are allowed, and public use is discouraged (Federal Committee on Ecological Reserves, 1977).

In addition to Research Natural Areas, the Fish and Wildlife Service also designates Public Use Natural Areas. Selection criteria are similar to those for research areas, but the former must be able to sustain limited public use without endangering the natural ecosystem (U.S. Dep. Interior, 1970). Two such areas have been designated within Seney National Wildlife Refuge.

Wilderness Designations

In 1964, Congress passed the Federal Wilderness Act to preserve large tracts of land in their natural states for the non-consumptive use and enjoyment of the American people. Since the law's enactment, over 100 tracts in the United States have received Wilderness designations, including four in Michigan.

To qualify for such designation, an area must be over 5000 acres (or an island), in Federal ownership, and "retaining its primeval character and influence, without permanent improvements or human habitation" (16 U.S.C. 1131). Once an area has received Wilderness designation (by an Act of Congress), the managing agency is responsible for maintaining it

in a wilderness condition. No roads, structures, motorized vehicles, or commercial enterprises are allowed, except where absolutely necessary to administer an area.

The development of the National Wilderness Preservation System, as mandated by the Wilderness Act, is an ongoing project, with new areas being added yearly. One of the most recent large-scale efforts to evaluate Federal lands for potential Wilderness is the RARE II (Roadless Area Review and Evaluation) program. In Michigan, eight areas, totalling 56,495 acres, were recommended for Wilderness designation by the U.S. Forest Service as a result of RARE II. This effort is discussed in greater detail under "Ongoing and Prospective Programs" (p. 218).

In addition to the three primary means of establishing nature preserves on Federal lands (as cited above), special protective designations are occasionally included in management plans to effectively create preserves. Two examples of this exist in Michigan. One, the Botanical Zone in Sylvania Recreation Area (Ottawa National Forest), was designated for "preservation and maintenance of the natural environmental values for the purpose of scientific study, public education and inspiration" (U.S. Dep. Agriculture, 1968). Accordingly, manipulation and removal of vegetation is not permitted, and development is limited to foot trails. Another similarly designated Federal area is the Nawaygo Prairie Ecological Study Area, in which a tract of remnant dry prairie has been preserved in Manistee National Forest.

The Federal government has also designated seven National Natural Landmarks in Michigan. These are Dukes Research Natural Area, Haven Hill Natural Area, Newton Woods, Strangmoor Bog, Tobico Marsh, Toumey Woodlot, and Waterloo Black Spruce Bog. Although it must be remembered that registration as a National Natural Landmark bestows no inherent protection, the nationally-recognized importance of these areas merits notation here.

Michigan Nature Association

To this date the Michigan Nature Association (MNA) is the only wholly in-state citizen group (i.e., without national affiliation) which owns and maintains a system of nature preserves. The MNA emerged in the early 1950's from a bird-study group in Macomb County. Its initial activities were local and primarily educational in character. In 1958, the organization redirected its goals toward preserving natural areas in southeastern Michigan, and it subsequently embarked on a program to independently acquire and protect natural areas, first in southeastern Michigan and later throughout the state. Its primary stated purposes in this endeavor have been "to preserve examples of Michigan's native plants and wildlife" through acquisition and maintenance of preserves, "and to carry on a program of natural history study and conservation education" (Michigan Nature Association, 1977).

The Michigan Nature Association established its first preserve, Red Wing Acres, in 1960 and has since accumulated over 55 preserves (more

than any other single organization in Michigan), comprising some 2900 acres. Recent activities have been particularly geared toward preserving (through acquisition) habitats of endangered, threatened, and rare plant species in Michigan.

Michigan Audubon Society

The Michigan Audubon Society was the first citizen organization in the state to own and administer nature preserve property. Bernard W. Baker of Marne, Michigan, donated nearly 500 acres to the Society in 1941, to be used primarily as a Sandhill Crane refuge (Walkinshaw, 1941a). The Society now holds seven sanctuaries, totalling 2140 acres, acquired largely through donation. An eighth area, Whitefish Point Bird Observatory, is leased by Audubon from the U.S. Coast Guard.

All sanctuaries are managed as nature preserves with occasional manipulation for wildlife habitat and varying degrees of development for public access and education. Seven Ponds Nature Center features an educational building and prairie reconstruction, but the remainder of its 243 acres remains undeveloped except for foot trails.

Miscellaneous Organizations

Various public and private organizations hold nature preserve property in relatively small quantities. A number of universities, for instance, have designated ecological preserves or nature research areas to be preserved in their natural states. In fact, the first formally-designated nature preserve in Michigan (now known as the Harvey N. Ott Preserve) was established by Battle Creek College in 1926.

County, township, and municipal governments represent another category of nature preserve property-holders. Not only are such local units of government often selected to assume ownership and administration of areas acquired by conservation organizations (e.g., The Nature Conservancy), but these agencies also frequently acquire valuable, locally-known areas on behalf of the public. A notable example of this is the Grass River Natural Area, an 830-acre parcel containing unusual riparian habitats, which has been acquired piecemeal by Antrim County to assure its preservation.

Local citizen groups are also sometimes active in natural area preservation. (The very influential Michigan Nature Association began as just such a group.) Several local citizen conservancies of recent origin include the Independence Land Conservancy, Little Traverse Conservancy, and the Long Lake Preservation Association. Such organizations can be highly effective within a small area, winning considerable local support for preservation of scientific as well as educational and scenic values.

A fine example of this is the Long Lake Preservation Association, which has declared its primary purposes to be "1) Natural history study and conservation education; and 2) Acquisition, maintenance, and protection of nature sanctuaries, natural areas, plant and animal reserves and other environmentally critical areas situated in and about Long Lake and

elsewhere in Long Lake and Green Lake Townships, Grand Traverse County. . ." (Long Lake Preservation Assoc., n.d.). Upon these principles, the Association has successfully completed its first project—the acquisition of a thirteen-acre island in Long Lake with very high "development" value.

Of the few privately-owned nature preserves in Michigan, the Huron Mountain Club Nature Research Area is by far the largest. It covers 17,700 acres in northern Marquette County, and was formally set aside by the Huron Mountain Club in the early 1960's (although the property has been owned and left largely undisturbed by the Club since the early 1900's).

Note: There has been no attempt to include public school system "preserves," which, although probably numerous, are scattered throughout the state and usually receive only informal protection.

IV. DESCRIPTIONS OF PRESERVES

Sources of Information

Of the 156 preserves listed herein, I was able to visit approximately half. Since it was not feasible to visit all, however—or to gather all necessary information in one visit—I have relied heavily on a number of sources judged reliable.

Michigan Natural Areas Council reports furnished a wealth of information about the topography and vegetation of many areas. Department of Natural Resources records were consulted for specifics on state preserves—e.g., names, dates, acreages, and locations. The Michigan Nature Association Sanctuary Guide provided diverse, though patchy, information about MNA's preserves. The Nature Conservancy records were also useful for the many preserves which TNC has helped to acquire, and the master plans which exist for most preserves administered by the Conservancy served as excellent references.

In addition, numerous miscellaneous publications, including previous studies and partial inventories of natural areas and nature preserves in Michigan (Brownian Movement, 1977; Buckman & Quintus, 1972; Chapman & Pleznac, 1978; Flaccus, 1972; Internatl. Union Conserv. Nat., 1975; Leverett, 1917; Nature Conservancy, 1977; Stearns & Lindsley, 1977) were helpful in locating and describing many preserves. However, since no written sources offered the entire spectrum of information needed for an inventory of this scope, it was necessary to contact many individuals on a personal basis through phone calls, letters, and visits (see Acknowledgments).

An attempt was made to systematically inventory university-owned nature preserves through distribution of letters and questionnaires to nearly ninety colleges and universities throughout Michigan. However, since only sixteen replies were received, this method did not contribute substantially to the overall project.

Explanation of Descriptions

In the subsequent section, each nature preserve is systematically described. The information included in these descriptions represents basic facts about each preserve and details thought useful to potential visitors and investigators. Each category of information presented is explained below.

NAME: The official name of the preserve, as designated by the owner, is given. Other commonly used names or previous names are listed in parentheses. (For cross references to closely associated preserves, see the Index List.)

TYPE: Two nature preserve types were designated for this study—natural area preserves and managed preserves—and have been defined above. Several preserves include both natural and managed portions; in such cases, both designations are listed.

ACREAGE: Present size is given to the nearest acre. For areas of less than ten acres, tenths are included, if known. (Acres have been chosen over hectares because acres are still the standard legal unit of land measurement in Michigan.)

LOCATION: No effort has been made to give directions to any preserves; proper authorities should be contacted for access permission and directions (see ADDRESS below). Location is given by section, township, and county if ten or fewer sections are involved, and by township and county only, for preserves covering more than ten sections. If a preserve is part of a larger designated administrative unit, for instance, a state park or national forest, the name of that unit is given.

PROTECTION: This indicates the form of protection given a preserve, in one of the three categories listed earlier under "Definition of Nature Preserve." Actual documents of protection were frequently not obtainable for first-hand inspection; in such cases, the form of protection listed is that reported by the owner or administrator.

DATE OF PROTECTION: This indicates the date at which the recognized form of protection was implemented. The day and month are given, if known; a year is cited in all cases, though in a few it may be noted as approximate. In some instances, enlargement or reduction of the originally-dedicated parcel may have occurred. No attempt has been made to recount dates of such alterations.

OWNERSHIP: The owner listed is the party which holds title to the property.

ADMINISTRATION: The administrator of a preserve is the party which makes policy decisions and therefore controls its use and management.

DEVELOPMENTS: Types of developments listed include foot trails, structures, service roads, and other relatively permanent modifications to the environment. In a very few preserves, camping and/or picnic facilities

are noted. Although, strictly speaking, these would fall outside the actual preserve boundaries (by definition of a nature preserve), they may be geographically within a preserve and included for administrative purposes.

MANAGEMENT: Included under this designation are ongoing environmental alterations with relatively short-term visible effects. All are intended to benefit an important species, group of species, or biotic community. Examples of management practices recognized include burning, mowing, cutting and planting for wildlife, and water level control.

GENERAL CHARACTER: I have attempted to summarize the basic physical and biological features of each preserve. However, because such information is often of limited availability, these summaries differ considerably in specificity. Also, some of the information was necessarily extrapolated from maps (floristic and geomorphic), sketchy descriptions, and brief visits, and therefore represents approximation rather than established fact.

Each characterization follows roughly the same form. First, a brief summary is given of geomorphology, including dominant landforms and special features. Next, major plant communities are listed, and important dominant species cited for each. Unusual floristic features are sometimes noted, but threatened and endangered species are intentionally omitted. The emphasis is on the plant communities, as indexed in Appendix D, not on individual species of particular interest from any one standpoint. Since wildlife of preserves is often poorly reported and not generally observable in a short visit, it is most difficult to summarize. Where information is available, I have listed a representation of species present, omitting those of very wide distribution (e.g., rabbits, chipmunks, bluejays, etc.). Often, no detailed information on wildlife was found and hence none is given.

REFERENCES: This section is not intended as a complete list of references, to account for all facts presented or all published work on an area. References cited are only examples of sources for more detailed accounts of physical and/or biological features. Many general references on the natural history of Michigan which were consulted during the course of this study are included in Brewer et al. (1978).

ADDRESS: The party listed here should be contacted for specific locality information, access permission, and answers to specific questions. Access permission should always be sought, unless a preserve is clearly open to the general public. In any case, the managing agency should be consulted before scientific studies are initiated. This assures that use restrictions will be understood and followed, and that the owner is aware of and has access to any findings.

1. Algonac State Park Sites

TYPE: natural area preserve/managed preserve

ACREAGE: 62

LOCATION: Sects. 27, 34, & 35, T3N, R16E; St. Clair Co.

PROTECTION: dedicated under administrative authority of Natural Resources Commission

DATE OF PROTECTION: 1970, March 12

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: none

MANAGEMENT: periodic mowing of prairie sites

GENERAL CHARACTER: These tracts lie on a low, sandy glacial lake plain of little relief. Four of the sites support mesic to wet prairie communities which include *Andropogon gerardii* (big bluestem), *Andropogon scoparius* (little bluestem), *Liatris* spp. (blazing-star), and *Solidago* spp. (goldenrod). The two remaining sites lie atop sandy ridges in the Park's western portion and are forested with *Quercus* spp. (oak), *Prunus serotina* (black cherry), and *Carya ovata* (shagbark hickory).

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

2. Allegan State Game Area Special Habitats

TYPE: natural area preserve/managed preserve

ACREAGE: 608

LOCATION: Sects. 26, 27, 34, 35, & 36, T3N, R15W; Allegan Co. (Allegan State Game Area).

PROTECTION: special designation by Wildlife Division, Michigan DNR

DATE OF PROTECTION: 1974

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Wildlife Division

DEVELOPMENTS: none

MANAGEMENT: periodic burning of oak savannah

GENERAL CHARACTER: The preserve acreage consists of three separate tracts in the northwest portion of the State Game Area. One tract includes the south edge of Miner's Lake and surrounding marshland, which is dominated by *Carex* spp. (sedge), *Calamagrostis canadensis* (bluejoint), and *Cladium mariscoides* (twig-rush). The adjacent forests are composed of *Quercus* spp. (oak) on the east, *Larix laricina* (tamarack) bog on the south, and *Acer rubrum* (red maple) swamp on the west.

A second tract lies in the Kalamazoo River valley and supports a *Thuja occidentalis* (white-cedar) swamp forest. *Tsuga canadensis* (hemlock), *Pinus strobus* (white pine), *Larix laricina* (tamarack), *Fraxinus nigra* (black ash), and *Betula alleghaniensis* (yellow birch) are also common, with *Lindera benzoin* (spicebush) abundant in the understory.

Oak savannah (often misleadingly called "pine plains") dominates the third protected tract. *Carex pensylvanica* (sedge), *Koeleria macrantha* (junegrass), and *Danthonia spicata* (oatgrass) dominate an open landscape with scattered individuals of *Quercus velutina* (black oak). Common forbs include *Lupinus perennis* (lupine), *Claytonia virginica* (spring beauty), *Lithospermum carolinense* (puccoon), *Coreopsis lanceolata* (coreopsis), *Asclepias tuberosa* (butterfly weed), and *Liatris cylindracea* (blazing star).

In addition to the wildlife species typical of these habitats, one finds wild turkey in the savannah (re-established), Canada warbler in the cedar swamp, and spotted turtle in the marsh.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Wildlife Division, Stevens T. Mason Bldg.
Lansing, MI 48909



2. Allegan State Game Area Special Habitat

3. Alta Warren Parsons Memorial Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 80

LOCATION: Sect. 2, T17N, R5W; Clare Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1976, December 17

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The Sanctuary includes frontage on Ferguson Lake, from which the land rises to the north. Springs in the lowland feed a stream which flows to the lake.

The upland is wooded with *Populus grandidentata* (bigtooth aspen), *Quercus* spp. (oak), *Prunus serotina* (black cherry), and *Pinus strobus* (white pine). The lowland supports a cedar swamp, and immediately bordering the northeast side of the lake is a floating bog mat of *Carex* spp. (sedge), *Vaccinium macrocarpon* (cranberry), *Menyanthes trifoliata* (bog buckbean), and *Andromeda glaucophylla* (bog rosemary).

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

4. Alton D. McGaw Memorial Plant Preserve

TYPE: natural area preserve

ACREAGE: 4.2

LOCATION: Sect. 13, T7N, R15E; St. Clair Co.

PROTECTION: Ownership by Michigan Nature Association

DATE OF PROTECTION: 1976, December 27

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: This small preserve lies largely in a marshy ravine fed by springs in the adjacent slopes. *Tsuga canadensis* (hemlock) dominates the hillside, while the wettest area supports *Caltha palustris* (marsh marigold).

REFERENCE: Daubendiek (pers. comm.).

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

5. Ann Arbor Wet Prairie

TYPE: managed preserve

ACREAGE: 5

LOCATION: Sect. 27, T2S, R6E; Washtenaw Co. (City of Ann Arbor).

PROTECTION: resolution by Ann Arbor Parks and Recreation Commission

DATE OF PROTECTION: 1969

OWNERSHIP: City of Ann Arbor

ADMINISTRATION: Ann Arbor Department of Parks

DEVELOPMENTS: foot trail along railroad

MANAGEMENT: periodic burning

GENERAL CHARACTER: The property lies on the floodplain of the Huron River and is bisected by a small tributary. The Penn-Central Railroad grade forms its western boundary, of which the easternmost 17 feet are leased as part of the preserve.

A wet prairie community which occupies the low-lying floodplain consists of over 150 vascular plant species, including *Silphium terebinthinaceum* (prairie-dock), *Ratibida pinnata* (yellow coneflower), *Vernonia missurica* (ironweed), *Saxifraga pensylvanica* (swamp saxifrage), and *Spartina pectinata* (cordgrass). The upland railroad terrace supports a more typically mesic prairie flora in which *Andropogon gerardii* (big bluestem) and *Sorghastrum nutans* (Indian grass) dominate. *Allium cernuum* (nodding onion), *Aureolaria flava* (smooth foxglove), *Liatis aspera* (blazing star), and *Coreopsis tripteris* (tall coreopsis) are among the other common species.

REFERENCES: Michigan Natural Areas Council, 1979a; Thompson, 1970.

ADDRESS: Ann Arbor Dept. of Parks
100 N. 5th. Ave., P.O. Box 8647
Ann Arbor, MI 48107

6. Anna Wilcox Memorial Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 45

LOCATION: Sect. 2, T3N, R12E; Macomb Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1975

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail system

MANAGEMENT: none

GENERAL CHARACTER: The Sanctuary is included in a clayey glacial lake plain of low relief. A stream crosses the southwestern corner of the property.

The preserve's southern 27 acres support a mixed hardwood forest. *Liriodendron tulipifera* (tuliptree) is an important component of this community, as are *Quercus bicolor* (swamp white oak), *Fagus grandifolia* (beech), *Acer rubrum* (red maple), *Tilia americana* (basswood), and *Fraxinus americana* (white ash). The northern 18 acres consist primarily of old-field associations. A marshy area supports such species as *Thelypteris palustris* (marsh fern), *Lobelia kalmii* (Kalm's lobelia), and *Gentiana* sp. (gentian).

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

7. Bakertown Fen

TYPE: managed preserve

ACREAGE: 6.1

LOCATION: Sect. 34, T7S, R18W; Berrien Co.

PROTECTION: legal agreement with The Nature Conservancy

DATE OF PROTECTION: 1978, December

OWNERSHIP: AMTRAK

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: none

MANAGEMENT: periodic burning and brush removal

GENERAL CHARACTER: Bakertown Fen occupies a railroad right-of-way and includes considerable diversity, with communities ranging from mesic and wet prairie to fen. Dominants in the former are *Andropogon gerardii* (big bluestem), *Sorghastrum nutans* (Indian grass), and *Carex stricta* (sedge). Other common forbs include *Phlox pilosa* (downy phlox), *Zigadenus glaucus* (white camas), and *Silphium terebinthinaceum* (prairie-dock).

REFERENCE: Kohring (pers. comm.).

ADDRESS: The Nature Conservancy

531 N. Clippert

Lansing, MI 48912

8. Barry State Game Area Special Habitat

TYPE: managed preserve

ACREAGE: 45

LOCATION: Sects. 10 & 15, T3N, R10W; Barry Co.

PROTECTION: special designation by Wildlife Division, Michigan DNR

DATE OF PROTECTION: ca. 1974

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Wildlife Division

DEVELOPMENTS: none

MANAGEMENT: periodic burning

GENERAL CHARACTER: A shallow depression of sandy glacial outwash dominates the topography of this preserve. Two streams flow through the tract. Old-field and sand barren communities border the bowl, whose margin supports mesic prairie of *Andropogon gerardii* (big bluestem), *Coreopsis tripteris* (coreopsis), *Ratibida pinnata* (yellow coneflower), and *Solidago* spp. (goldenrod). In the more central wet prairie-fen, *Spartina pectinata* (prairie cordgrass), *Calamagrostis canadensis* (bluejoint), and *Potentilla fruticosa* (shrubby cinquefoil) dominate.

Among wildlife species of special interest are Henslow's and grasshopper sparrows.

REFERENCE: Schaddelee (pers. comm.).

ADDRESS: Michigan Dept. of Natural Resources

Wildlife Division, Stevens T. Mason Bldg.

Lansing, MI 48909

9. Beaver Dam Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 40

LOCATION: Sect. 27, T42N, R1W; Mackinac Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1970, December 28

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Swamp and beaver ponds dominate this preserve, which lies on a glacial till plain. Components of the swamp forest include *Populus* spp. (aspens), *Larix laricina* (tamarack), and *Abies balsamea* (balsam fir). *Alnus rugosa* (alder), *Spiraea tomentosa* (spiraea), *Cornus stolonifera* (red-osier dogwood), *Myrica gale* (sweet gale), and *Salix* spp. (willow) dominate the understory and thickets.

This preserve provides habitat for several uncommon bird species, including Wilson's snipe, hooded merganser, red-breasted nuthatch, and olive-sided flycatcher. A number of mammals also inhabit the area, among them weasel, mink, otter, and, of course, beaver.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

10. Bernard W. Baker Sanctuary

TYPE: natural area preserve/managed preserve

ACREAGE: 897

LOCATION: Sects. 10, 14, 15, & 16, T1S, R6W; Calhoun Co.

PROTECTION: ownership by Michigan Audubon Society

DATE OF PROTECTION: 1941

OWNERSHIP: Michigan Audubon Society

ADMINISTRATION: Michigan Audubon Society

DEVELOPMENTS: foot trails, small lodge, 200-acre wildlife flooding

MANAGEMENT: maintenance of flooding water level, 20 acres planted for wildlife food, 50 acres mowed to maintain open habitat

GENERAL CHARACTER: The Sanctuary is situated on a low-lying till plain, with much of its acreage below the water table. Artificial water level control maintains Big Marsh Lake, a 200-acre impoundment averaging around 2 feet in depth.

Upland plant communities consist primarily of old fields and oak woodland. Two forest associations occur in the Sanctuary's lowland—*Larix laricina* (tamarack) swamp and hardwood forest. The latter is composed of *Ulmus* sp. (elm), *Tilia americana* (basswood), *Fraxinus* spp. (ash), *Quercus* spp. (oak), *Acer* spp. (maple), and *Populus deltoides* (cottonwood). The remaining lowland acreage is shared by shrub carr, open marsh and cultivated or mowed fields.

Deer, mink, muskrat, fox, and raccoon inhabit the preserve. Among the two hundred birds reported from the area are the sandhill crane, yellow-billed cuckoo, and ruffed grouse.

REFERENCES: Beard, 1950; Reed (pers. comm.); Walkinshaw, 1941a, 1941b, 1961, 1962.

ADDRESS: Michigan Audubon Society
7000 N. Westnedge Ave.
Kalamazoo, MI 49001

11. Besser Natural Area

TYPE: natural area preserve

ACREAGE: 134

LOCATION: Sects. 13 & 24, T33N, R8E; Presque Isle Co. (Alpena State Forest).

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1966, January 14

OWNERSHIP: State of Michigan

ADMINISTRATION: Department of Natural Resources, Forestry Division

DEVELOPMENTS: foot trail, remnants of abandoned logging settlement

MANAGEMENT: none

GENERAL CHARACTER: The property's most outstanding geomorphic feature is its 4125 feet of frontage on Lake Huron, composed primarily of limestone gravel shore. About 500 feet of sandy shore and low dunes lie near the southern boundary, bordering a lagoon-type pond of nearly 2.5 acres.

The dominant vegetation on the tract is a forest of virgin *Pinus strobus* (white pine) and *Pinus resinosa* (red pine) intermixed with *Thuja occidentalis* (white-cedar), *Picea* sp. (spruce), *Abies balsamea* (balsam fir), *Populus* spp. (poplar), and *Betula papyrifera* (paper birch).

ADDRESS: Michigan Dept. of Natural Resources
Forestry Division, Stevens T. Mason Bldg.
Lansing, MI 48909

12. Betsy Lake Research Natural Area

TYPE: natural area preserve

ACREAGE: 14,919

LOCATION: T49N, R8W, Luce Co.; T49N, R7W; Chippewa Co. (Tahquamenon Falls State Park).

PROTECTION: pending under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1954, August 13

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trail system south of Clark and Betsy Lakes

MANAGEMENT: none

GENERAL CHARACTER: The lowland portion of this preserve occupies the former bed of glacial Lake Algonquin, which is veneered with sand and clay. Fossil dunes and sandy beach ridges, oriented east-west, rise above this plain to heights of 10–40 feet. With drainage to the northeast slowed by differential post-glacial uplift and locally blocked by the scattered ridges, a patterned marshland or string bog has developed. The Munising moraine, a complex of knolls and depressions partly covered with eolian sand, arises immediately south of Clark Lake. At certain elevations on the moraine are beach terraces formed by the recession of Lake Algonquin.

Vegetation of the open marshland resembles that of typical bog lakes. On a bed of sphagnum are commonly found *Carex* spp. (sedge), *Rhynchospora* spp. (beak-rush), *Drosera rotundifolia* (sundew), *Eriophorum* spp. (cotton-grass), *Sarracenia purpurea* (pitcher plant), and *Calopogon tuberosus* (grass-pink), with scattered shrubs of *Ledum groenlandicum* (Labrador-tea), *Chamaedaphne calyculata* (leatherleaf), and *Kalmia polifolia* (swamp laurel), and stunted individuals of *Larix laricina* (tamarack). Riparian swamp communities of *Ulmus* sp. (elm), *Fraxinus nigra* (black ash), *Salix* spp. (willow), and *Alnus rugosa* (alder) occur along streams. The scattered fossil dunes and beach ridges are dominated by *Pinus resinosa* (red pine) and *Betula papyrifera* (paper birch). Bordering these ridges lie bog forests of *Thuja occidentalis* (white-cedar), *Larix laricina* (tamarack), and *Picea mariana* (black spruce).

The morainal complex to the south is covered on its lower, northernmost portion by a *Pinus resinosa* (red pine)-*Betula papyrifera* (paper birch) association on the knolls and bog or bog-forest communities in the intervening depressions. Farther south on the higher portion of the moraine, as the eolian sand



veneer thins and drainage improves, the upland forest develops into a *Tsuga canadensis* (hemlock)-*Betula alleghaniensis* (yellow birch)-*Fagus grandifolia* (beech)-*Acer saccharum* (sugar maple) association. The lowland forests in this area often consist of *Tsuga canadensis* (hemlock), *Thuja occidentalis* (white-cedar), and *Acer rubrum* (red maple) on a bed of *Sphagnum* spp.

REFERENCES: Bergquist, 1931, 1936; Leverett, 1929.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

13. Big Hand Road Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 5.4

LOCATION: Sect. 27, T5N, R15E; St. Clair Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1967, March 22

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: This preserve lies on the clayey former bed of Glacial Lake Maumee, now shallowly dissected by stream action.

Covering the upland is an oak-dominated forest of *Quercus rubra* (red oak), *Quercus alba* (white oak), *Prunus serotina* (black cherry), and *Pinus strobus* (white pine). In lower, moister spots, *Acer saccharum* (sugar maple), *Fagus grandifolia* (beech), and *Acer nigrum* (black maple) predominate. Swamp forest occupies the lowest areas, and includes *Tilia americana* (basswood), *Fraxinus americana* (white ash), *Acer rubrum* (red maple), and *Betula alleghaniensis* (yellow birch).

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

14. Big Stone-Cecil Bay Nature Study Preserve

TYPE: natural area preserve

ACREAGE: 1360

LOCATION: Sects. 25-27, 35, & 36, T39N, R5W; Emmet Co. (Wilderness State Park).

PROTECTION: dedicated under administrative authority of Natural Resources Commission

DATE OF PROTECTION: 1951, April 19

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trails, dirt road, cabin, trailside shelter

MANAGEMENT: none

GENERAL CHARACTER: The tract is topographically diverse, with high fossil dunes bordering glacial lake plain lowlands. Big Stone Creek flows through a portion of the area and is dammed to create a pond on its western extreme.

The lowland portion supports swamps of *Thuja occidentalis* (white-cedar), *Picea mariana* (black spruce), and *Larix laricina* (tamarack). Mixed hardwood-conifer forests of varying composition and maturity occupy the dune ridges. These range from *Populus* spp. (aspen), *Pinus* spp. (pines), and *Betula papyrifera* (paper birch) to *Fagus grandifolia* (beech), *Acer* spp. (maple), and *Tsuga canadensis* (hemlock).

A number of uncommon bird and mammal species have been reported from the park, including magnolia warbler, Wilson's snipe, parula warbler, northern flying squirrel, and water shrew.

REFERENCES: Michigan Natural Areas Council, 1979a; Pettingill et al., 1957.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

15. Bird Island Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 2

LOCATION: Sect. 22, T29N, R9E; Alpena Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1976, April 2

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: This small limestone cobble island is sparsely vegetated, with *Fraxinus pennsylvanica* (red ash) nearly the only tree species. Ring-billed gulls utilize the island heavily for nesting. Canada geese also frequent the island.

REFERENCE: Holzman (pers. comm.).

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

16. Briggs Memorial Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 40

LOCATION: Sect. 15, T17N, R2E; Gladwin Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1979, December

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Glacial lake-bed sediments form the gentle topography of this preserve. A small stream passes through the tract. Much of the preserve is upland and supports a successional forest of *Populus grandidentata* (large-toothed aspen) and *Betula papyrifera* (paper birch). In lower areas, *Ulmus americana* (elm) and *Fraxinus* sp. (ash) become important.

Common birds of the preserve include wood thrush, several warblers, veery, and ovenbird.

REFERENCE: Daubendiek (pers. comm.).

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

17. Brockway Mountain Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 78

LOCATION: Sect. 31, T59N, R28W; Keweenaw Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1979, October 29

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies very near the "nose" of Brockway Mountain, on its extreme eastern end. Here, the great conglomerate ridge gives way in a steep slope dropping 300 feet to the valley containing US-41.

Stunted *Acer saccharum* (sugar maple) and *Populus tremuloides* (quaking aspen) and numerous shrubs, including *Rubus parviflorus* (thimbleberry) and *Shepherdia canadensis* (sheepberry), dominate the upland and slope, while the valley supports mixed hardwoods and conifer swamp.

REFERENCE: Michigan Nature Association, 1979a.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

18. Bullock Creek Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 80

LOCATION: Sect. 16, T13N, R1E; Midland Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1978, October 20

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: On this tract of former glacial lake plain, sandy ridges trend east-west through a marshy lowland. These ridges, along with the preserve's western upland portion, support open, patchy woods of *Quercus rubra* (red oak) and *Pinus* spp. (pine). Flanking these sandy ridges to the east are lowland *Fraxinus* (ash)-*Quercus* (oak) and *Acer* (maple)-*Betula* (birch) associations and marshes dominated by *Vaccinium* sp. (blueberry) and *Carex* spp. (sedge). An old-field community lies near the tract's southeastern corner.

REFERENCE: Daubendiek, (pers. comm.).

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

19. Calla C. Burr Memorial Plant Preserve

TYPE: natural area preserve

ACREAGE: 5

LOCATION: Sect. 12, T4N, R7E; Oakland Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1970

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve occupies a low triangle of land, the wetter portion of which supports a marsh of *Carex stricta* (sedge) and *Typha angustifolia* (cattail). On better-drained soil, wet prairie and fen elements comprise a community dominated by *Sorghastrum nutans* (Indian grass) and *Andropogon gerardii* (big bluestem).

REFERENCE: Kohring (pers. comm.)

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

20. Cedar River Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 80

LOCATION: Sect. 36, T30N, R7W; Antrim Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1971, January 6

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve borders on the Cedar River and supports, adjacent to the river, a swamp of *Thuja occidentalis* (white-cedar), *Larix laricina* (tamarack), and *Betula alleghaniensis* (yellow birch). On higher ground, farther from the river, this gives way to a mosaic of *Picea mariana* (black spruce), *Acer rubrum* (red maple), and *Betula papyrifera* (paper birch).

REFERENCE: Kohring (pers. comm.).

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

21. Cranbrook Nature Sanctuary (Ward Nature Study Area)

TYPE: natural area preserve/managed preserve

ACREAGE: 50

LOCATION: Sect. 15, T2N, R9E; Oakland Co.

PROTECTION: resolution by Cranbrook Board of Governors

DATE OF PROTECTION: 1969, December 11

OWNERSHIP: Cranbrook Institute of Science

ADMINISTRATION: Cranbrook Nature Center

DEVELOPMENTS: foot trails and shelter

MANAGEMENT: periodic burning of 6-acre prairie reconstruction

GENERAL CHARACTER: The preserve lies on a rolling interlobate moraine and includes frontage on Orchard and Upper Straits Lakes. A virgin forest of *Quercus* spp. (oak) and *Carya ovata* (shagbark hickory) dominates 20 acres, and is thought by many to constitute the finest example of oak-hickory forest in southern Michigan. Individual trees in this stand often exceed 36 inches dbh and 200 years in age.

Two unwooded communities also occupy the preserve, one, an early-succession old field, and the other a marsh of *Typha latifolia* (cattail), *Salix* spp. (willow), *Cephalanthus occidentalis* (buttonbush), and *Cornus stolonifera* (red-osier dogwood).

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Cranbrook Institute of Science
500 Lone Pine Rd.
Bloomfield Hills, MI 48013

22. Crane Island Natural Area Preserve

TYPE: natural area preserve

ACREAGE: 230

LOCATION: Sects. 15-17 & 20-22, T39N, R6W; Emmet Co. (Wilderness State Park).

PROTECTION: dedicated under administrative authority of Natural Resources Commission

DATE OF PROTECTION: 1951, April 19

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Crane Island (and/or Waugoshance Island) is geographically similar to Waugoshance Point and has low, broad gravel shores to the south with narrow dunes and a sandy shore to the north.

On the wet gravel shores, *Primula mistassinica* (bird's-eye primrose), *Selaginella* spp., *Castilleja coccinea* (Indian paintbrush), and *Senecio pauperculus* (ragwort) abound. A characteristic sand flora occupies the low dunes and pools. The island's narrow interior supports mixed hardwood-conifer forests in upland areas, and *Thuja occidentalis* (white-cedar)-*Picea glauca* (white spruce) associations in the wetpannes.

Birds known to nest on Waugoshance Point—e.g., Piping plover, American bittern, spotted sandpiper, and kingbird—undoubtedly also inhabit the island.

REFERENCES: Michigan Natural Areas Council, 1979a. Pettingill et al., 1957; Schnell, 1967.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

23. Dayton Wet Prairie

TYPE: managed preserve

ACREAGE: 20

LOCATION: Sect. 16, T8S, R18W; Berrien Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1978, December

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: none

MANAGEMENT: periodic burning

GENERAL CHARACTER: This low-lying tract, founded upon glacial outwash, consists primarily of shrub carr in which *Cornus racemosa* (gray dogwood), *Cornus stolonifera* (red-osier dogwood), *Salix* spp. (willow), and *Viburnum lentago* (nannyberry) predominate. Wet prairie occurs in scattered patches throughout the preserve. Common dominants of the prairie communities include *Carex* spp. (sedge), *Andropogon gerardii* (big bluestem), and *Typha* sp. (cattail).

REFERENCE: Michigan Natural Areas Council, 1979b.

ADDRESS: The Nature Conservancy
531 N. Clippert
Lansing, MI 48912

24. Donahey Woods

TYPE: natural area preserve

ACREAGE: 22

LOCATION: Sect. 1, T49N, R14W; Alger Co.

PROTECTION: deed restriction

DATE OF PROTECTION: 1976, March 15

OWNERSHIP: Burt Township

ADMINISTRATION: Burt Township

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: Fronting on Lake Superior, the property consists of rolling, forested dunes bisected by a small stream.

The forest is a mature hemlock-northern hardwoods association dominated by *Fagus grandifolia* (beech), *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), and *Tsuga canadensis* (hemlock), with a scattering of *Betula papyrifera* (paper birch), *Picea glauca* (white spruce), and *Abies balsamea* (balsam fir). A broad, sandy beach supports only a sparse growth of beach grasses, due to heavy use by campers from the adjacent township park.

ADDRESS: Burt Township Supervisor
Grand Marais, MI 49839

25. Dukes Research Natural Area (Northern Hardwood Research Natural Area)

TYPE: natural area preserve

ACREAGE: 233

LOCATION: Sect. 23, T46N, R23W; Marquette Co. (Hiawatha National Forest)

PROTECTION: designation as Research Natural Area by U.S. Forest Service

DATE OF PROTECTION: 1974

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Forest Service, Hiawatha National Forest

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Situated on a glacial till plain, the tract possesses a gently rolling topography. A small stream flows northward from the center of the property.

Vegetation consists largely of northern hardwoods, intermixed, in spots, with *Tsuga canadensis* (hemlock) and *Pinus strobus* (white pine). Several small stands of pure hemlock occur in the preserve's southwestern portion. Old-growth swamps of *Thuja occidentalis* (white-cedar) and *Picea* sp. (spruce) occupy some 47 acres and constitute a major feature of the preserve's vegetation.

REFERENCE: Federal Committee on Ecological Reserves, 1977.

ADDRESS: North Central Forest Experiment Station
1030 Wright St.
Marquette, MI 49855

26. Erie Marsh Preserve

TYPE: natural area preserve/managed preserve

ACREAGE: 2168

LOCATION: T8S, R8E; Monroe Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1978, December 22

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: approximately 50% diked; several residences on southwest end

MANAGEMENT: planting of waterfowl food plants and water level control only in diked portion

GENERAL CHARACTER: This tract lies on the marshy edge of Lake Erie. Artificial dikes are widely scattered through the area and rise above the natural topography which lies at or below the water table most of the time.

Salix spp. (willow) and *Populus* sp. (poplar) dominate the dikes; otherwise few trees are to be found. Important marsh species include *Typha* spp. (cattail), *Polygonum* spp. (smartweed), *Carex* spp. (sedge), and *Scirpus* spp. (bulrush).

Bird life of the preserve is especially diverse. In addition to large numbers of migrating birds, waterfowl and shore birds are plentiful and include great blue heron and black-crowned night heron, with occasional bald eagle and snowy egret. The eastern fox snake is also present, in addition to common mammals such as fox, muskrat, deer, and raccoon.

REFERENCE: Nature Conservancy, Michigan Field Office, 1979.

ADDRESS: The Nature Conservancy

531 N. Clippert

Lansing, MI 48912

27. Estivant Pines Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 200

LOCATION: Sect. 8, T58N, R28W; Keweenaw Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1973, August 17

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: Located on a formation of Lower Keweenawan volcanics, this tract supports an old-growth northern hardwood stand which has undergone very little lumbering. *Acer saccharum* (sugar maple) dominates the forest, but its most outstanding feature is a scattering of large *Pinus strobus* (white pine), reaching up to 150 ft. in height, 2½ ft. in diameter, and 492 years of age. Other common tree species include *Betula papyrifera* (paper birch), *Abies balsamea* (balsam fir), *Acer rubrum* (red maple), and *Quercus rubra* (red oak). A low, swampy area on the southern portion of the tract supports a growth of *Thuja occidentalis* (white-cedar), *Picea mariana* (black spruce), and *Acer spicatum* (mountain maple).

Mammals known from the area include bear and coyote, and pileated woodpecker, barred owl, snowy owl, northern wood warbler, and goshawk are among the birds sighted there.

REFERENCES: Eshbach, 1976; Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043



27. Estivant Pines Nature Sanctuary (R. Polovich, MNA)

28. Fernwood Nature Study Area

TYPE: natural area preserve

ACREAGE: 18

LOCATION: Sect. 13, T7S, R18W; Berrien Co.

PROTECTION: dedication by Fernwood, Inc.

DATE OF PROTECTION: 1968, October 6

OWNERSHIP: Fernwood, Inc.

ADMINISTRATION: Fernwood, Inc.

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: Fernwood's preserve property lies along the St. Joseph River, where the latter bisects the Valparaiso Moraine. The Nature Study Area extends from atop the moraine to the floodplain of the river.

The entire area is wooded, with the upland forest dominated by *Quercus* spp. (oak) and *Carya* spp. (hickory), with some *Sassafras albidum* (sassafras). On the rather steep slope bordering the morainal upland, *Fagus grandifolia* (beech), *Acer saccharum* (sugar maple), and *Prunus serotina* (black cherry) appear as important species. The lower, gentler slopes and floodplain are wooded with *Ulmus americana* (elm), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Tilia americana* (basswood), *Platanus occidentalis* (sycamore), and *Salix* spp. (willow).

REFERENCES: Kapp, 1969; Lindsey & Escobar, 1976; Michigan Natural Areas Council, 1979a.

ADDRESS: Fernwood, Inc.

1720 Range Line Rd.

Niles, MI 49120

29. Fish Lake Bog Plant Preserve

TYPE: natural area preserve

ACREAGE: 15

LOCATION: Sect. 26, T3S, R6W; Calhoun Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1967, March 25

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on the south side of Fish Lake where a wooded upland gives way to a floating bog mat. The large open portion of the mat is dominated by *Carex* spp. (sedge), *Chamaedaphne calyculata* (leatherleaf), and *Vaccinium macrocarpon* (cranberry). Bordering the open mat is a zone of *Larix laricina* (tamarack) and *Toxicodendron vernix* (poison sumac).

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

30. Five Lakes Muskegon Plant Preserve

TYPE: natural area preserve

ACREAGE: 20

LOCATION: Sect. 32, T10N, R15W; Muskegon Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1977, May 12

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Shallow lakes with widely fluctuating water levels occupy this area of sandy former glacial lake bottom.

Backed by *Quercus* spp. (oak) forest, the sandy-mucky shores harbor a number of coastal plain disjunct species which appear as the lake dries during the summer. A few common species include *Agalinis purpurea* (gerardia), *Fimbristylis autumnalis*, and *Carex* spp. (sedge).

REFERENCES: Churchill, 1976; Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043



30. Five Lakes Muskegon Plant Preserve (C. Alway)

31. Flowerfield Creek Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 20

LOCATION: Sect. 20, T4S, R12W; Kalamazoo Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1978, June 5

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Low, level glacial outwash forms the topography of this preserve. The area is entirely forested, supporting mostly *Ulmus americana* (elm) and *Acer rubrum* (red maple) swamp forest, with a central "island" of *Fagus grandifolia* (beech) and *Acer saccharum* (sugar maple).

REFERENCE: Kohring (pers. comm.).

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

32. Flowering Dogwood Plant Preserve

TYPE: natural area preserve

ACREAGE: 10

LOCATION: Sect. 34, T3S, R6W; Calhoun Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1970, November 13

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: A flat, rich lowland here supports a diverse forest of mesic hardwoods. *Cornus florida* (flowering dogwood) is very common in the understory.

REFERENCE: Holzman (pers. comm.).

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

33. Grand Beach Prairie

TYPE: managed preserve

ACREAGE: 3.3

LOCATION: Sects. 17, 18, & 19, T8S, R21W; Berrien Co.

PROTECTION: legal agreement with The Nature Conservancy

DATE OF PROTECTION: 1978, December

OWNERSHIP: AMTRAK

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: none

MANAGEMENT: periodic burning and brush removal

GENERAL CHARACTER: This narrow strip of remnant prairie lies in a flat, sandy area bordered by *Quercus* spp. (oak) and *Pinus* sp. (pine) forests. *Andropogon scoparius* (little bluestem) dominates the tract, and is accompanied by *Sorghastrum nutans* (Indian grass), *Lespedeza capitata* (bush clover), *Panicum depauperatum* (starved panic grass), and *Asclepias tuberosa* (butterflyweed).

REFERENCE: Michigan Natural Areas Council, 1978.

ADDRESS: The Nature Conservancy

531 N. Clippert

Lansing, MI 48912

34. Grand Island Research Natural Area

TYPE: natural area preserve

ACREAGE: 59

LOCATION: Sect. 15, T48N, R19W, Alger Co. (Hiawatha National Forest).

PROTECTION: designation as Research Natural Area by U.S. Forest Service

DATE OF PROTECTION: 1977, January 12

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Forest Service, Hiawatha National Forest

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: This preserve is located on the north shore of Grand Island where the bedrock, Jacobsville sandstone, is buried by the sandy deposits of the postglacial Nipissing Great Lakes. The only major bedrock outcrop is a 100-foot cliff bordering Lake Superior in the tract's eastern portion.

A mature northern hardwood association dominates most of the preserve. The importance of *Fagus grandifolia* (beech) is notable, since it occurs here very near the northwestern limit of its range. Other important species include *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), *Tsuga canadensis* (hemlock), and *Betula alleghaniensis* (yellow birch). Two additional forest types present are a *Tsuga canadensis* (hemlock)-*Thuja occidentalis* (white-cedar)-*Abies balsamea* (balsam fir) association along Echo Lake Creek, and a thin-soil community of northern hardwoods, *Sorbus decora* (mountain ash), *Betula papyrifera* (paper birch), *Acer spicatum* (mountain maple), and *Pinus* spp. (pine) on the sandstone outcropping.

REFERENCE: U.S. Dep. Agr., Forest Service, 1974.

ADDRESS: North Central Forest Experiment Station

1030 Wright St.

Marquette, MI 49855

35. Grand Mere Nature Study Preserve

TYPE: natural area preserve

ACREAGE: 22

LOCATION: Sect. 31, T5S, R19W; Berrien Co.
PROTECTION: designation by Kalamazoo Nature Center
DATE OF PROTECTION: ca. 1969
OWNERSHIP: Kalamazoo Nature Center
ADMINISTRATION: Kalamazoo Nature Center
DEVELOPMENTS: foot trail
MANAGEMENT: none
GENERAL CHARACTER: The preserve lies on Nipissing dunes which formed atop a barrier beach in the mouth of the Grand Mere Embayment. The dunes are now wooded with a mature forest of *Quercus velutina* (black oak), *Fagus grandifolia* (beech), and *Acer saccharum* (sugar maple), with *Tsuga canadensis* (hemlock) on north-facing slopes.
Birds of the preserve include yellow-billed and black-billed cuckoo, great horned owl and hairy, downy, and red-bellied woodpecker.
REFERENCES: Grand Mere Association, 1973; Tague, 1947.
ADDRESS: Grand Mere Association
Box 140
Stevensville, MI 49124

36. Grass Island Nature Sanctuary

TYPE: natural area preserve
ACREAGE: 3.3
LOCATION: Sect. 34, T31N, R8E; Alpena Co.
PROTECTION: ownership by Michigan Nature Association
DATE OF PROTECTION: 1977, June 17
OWNERSHIP: Michigan Nature Association
ADMINISTRATION: Michigan Nature Association
DEVELOPMENTS: none
MANAGEMENT: none
GENERAL CHARACTER: The preserve consists of limestone rubble (Traverse Group) which supports a forest dominated by *Fraxinus pennsylvanica* (red ash). Gulls utilize the weedy shores for nesting and various other water and shore birds frequent the island.
REFERENCE: Holzman (pers. comm.).
ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

37. Grass River Natural Area

TYPE: natural area preserve
ACREAGE: 830
LOCATION: Sect. 1 & 12, T29N, R8W; Sect. 7, T29N, R7W; Antrim Co.
PROTECTION: deed restriction
DATE OF PROTECTION: 1971, September 2
OWNERSHIP: Antrim County
ADMINISTRATION: Antrim County Board of Commissioners
DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: As its name implies, the preserve lies along the Grass River, which flows from Lake Bellaire into Clam Lake. The area was inundated post-glacially by Lake Algonquin and is veneered with sand deposited during that period.

Vegetating the river bottom are *Vallisneria americana* (eelgrass), *Potamogeton* spp. (pondweed), *Elodea canadensis* (waterweed), and *Ceratophyllum demersum* (hornwort). A sphagnum-sedge mat immediately borders the stream, and supports such characteristic "bog" species as *Sarracenia purpurea* (pitcher plant), *Drosera rotundifolia* (sundew), *Potentilla fruticosa* (shrubby cinquefoil), and *Decodon verticillatus* (swamp loose-strife). Backing this open area is a dense *Thuja occidentalis* (white-cedar) swamp. An unusual expanse of sedge meadow occurs at the north end of the area as a peninsula extending into Lake Bellaire. Important species here include *Carex aquatilis* (sedge), *Rhynchospora alba* (beak-rush), *Scirpus acutus* (bulrush), *Cladium mariscoides* (twig-rush), and *Menyanthes trifoliata* (bog buckbean).

The preserve also supports a diverse fauna, including otter, bear, osprey, and bald eagle. Waterfowl which utilize the Grass River include whistling and mute swans, and a variety of ducks.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Soil Conservation Service

110B Grove St.

Bellaire, MI 49615

38. Green River Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 40

LOCATION: Sect. 5, T30N, R6W; Antrim Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: ca. 1969

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The Green River flows through this preserve for approximately one-quarter mile. The adjacent land is low-lying and supports swamp forests of *Thuja occidentalis* (white-cedar), *Picea mariana* (black spruce), and *Tsuga canadensis* (hemlock).

REFERENCE: Kohring (pers. comm.).

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

39. Gull Island Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 12

LOCATION: Sect. 29, T31N, R10E; Alpena Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1969, January 18

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Gull Island is perched upon an outcropping of Alpena Limestone in Lake Huron. Vegetative diversity is limited—*Fraxinus pennsylvanica* (red ash), and *Thuja occidentalis* (white-cedar) account for most of the trees present. Much of the herbaceous flora consists of weedy species.

Of primary interest on this preserve is a herring gull colony of up to 2000 pairs which nest on the gravelly shores. The great blue Heron and black-crowned night heron occupy the island's central portion. Canada geese and ducks also utilize the island for nesting.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

40. Harbor Island

TYPE: managed preserve

ACREAGE: 695

LOCATION: Sects. 1, 2, 11, & 12, T42N, R5E; Chippewa Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1979, November 9

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: one residence

MANAGEMENT: deer herd control to reduce browsing

GENERAL CHARACTER: Located just off the northwest shore of Drummond Island, horseshoe-shaped Harbor Island is on the calcareous Niagaran cuesta. Marly marshes with occasional sandy beaches comprise the island's shoreline. Backing these shores are *Abies balsamea* (balsam fir)-*Thuja occidentalis* (white-cedar) swamps, inland from which, the land rises about 100 feet to a high central backbone forested with *Quercus rubra* (red oak) and *Acer saccharum* (sugar maple).

Bald eagle, osprey, and great blue heron have been known to nest on the island.

REFERENCE: Kohring (pers. comm.).

ADDRESS: The Nature Conservancy

531 N. Clippert

Lansing, MI 48912

41. Harvey N. Ott Preserve

TYPE: natural area preserve

ACREAGE: 256

LOCATION: Sects. 3, 4, 9, & 10, T2S, R7W; Calhoun Co.

PROTECTION: resolution by County Board of Commissioners (originally dedicated by Battle Creek College).

DATE OF PROTECTION: 1926

OWNERSHIP: Calhoun County

ADMINISTRATION: Calhoun County Parks & Recreation Commission

DEVELOPMENTS: maintenance road, foot trails

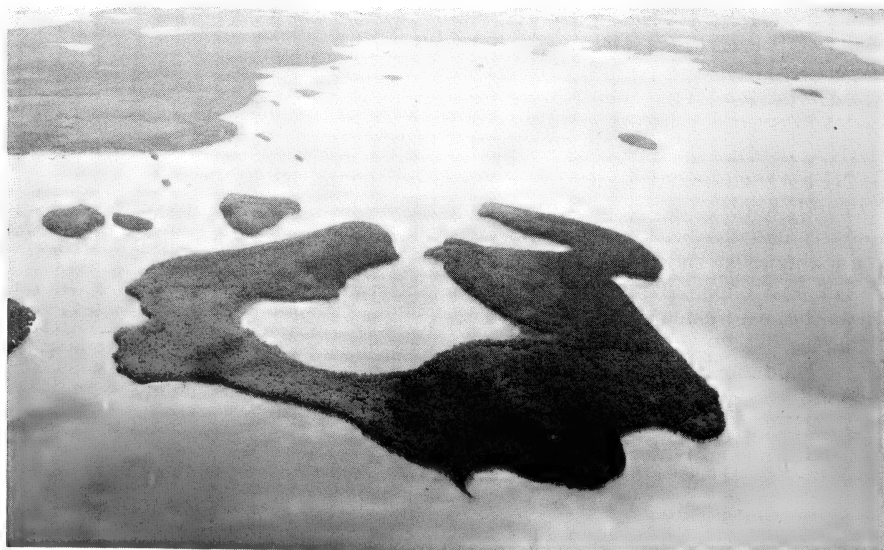
MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on pitted glacial drift and includes one lake and portions of two others. The area's most noteworthy geomorphic feature, an esker, extends for nearly one mile from the northeast to southwest corners, interrupted in only three places by stream action.

Old fields and upland hardwoods occupy the esker and the periphery of the property. Dominants of the latter community are *Quercus* spp. (oak) and *Prunus serotina* (black cherry). The large central portion of the preserve supports a lowland hardwood forest of *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), and *Ulmus americana* (elm). Bog vegetation surrounds much of Brigham and Hall Lakes, with open sphagnum-sedge mats backed by *Larix laricina* (tamarack) swamp forest. Two open marshes support numerous grasses and sedges, as well as *Utricularia* sp. (bladderwort) and *Potentilla palustris* (marsh cinquefoil).

REFERENCES: Catana, 1967; Gilbert, 1954; Lindsey & Escobar, 1976.

ADDRESS: Calhoun County Parks and Recreation Commission
303 S. Grand
Marshall, MI 49068



40. Harbor Island (T. Cline, TNA)

42. Haven Hill Natural Area

TYPE: natural area preserve

ACREAGE: 721

LOCATION: Sects. 19 & 24, T3N, R8E; Oakland Co. (Highland Recreation Area).

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1954, August 13

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trail system

MANAGEMENT: none

GENERAL CHARACTER: An interlobate glacial moraine forms the hills of the tract, with glacial outwash lying to the south and east. Haven Hill Lake was created largely by a dam constructed at its outlet.

On the morainal upland, *Quercus rubra* (red oak), *Quercus alba* (white oak), and *Carya* spp. (hickory) predominate. On the low-lying outwash and in isolated, low, pitted areas of the moraine, a number of swamp forest types occur. Most extensive of these are hardwood swamps of *Ulmus americana* (elm), *Fraxinus nigra* (black ash), and *Tilia americana* (basswood). Conifer swamps include *Thuja occidentalis* (white-cedar)-*Betula alleghaniensis* (yellow birch) and *Larix laricina* (tamarack)-*Toxicodendron vernix* (poison sumac) associations. Several higher "islands" of *Acer saccharum* (sugar maple)-*Fagus grandifolia* (beech) forest are scattered on the outwash plain.

Mink, badger, red fox, opossum, and a number of smaller mammals are known from the preserve. Among the many birds reported are ruffed grouse, cerulean warbler, ovenbird, great horned owl, redpoll, snow bunting, and turkey vulture. Haven Hill Lake is home to a sizable flock of Canada geese.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

43. Helmer Brook Prairie Plant Preserve

TYPE: natural area preserve

ACREAGE: 10

LOCATION: Sect. 33, T1S, R8W; Calhoun Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1979

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: This tract lies on an extensive plain of glacial outwash. Locally, the property is bounded on the south by railroad tracks and slopes northward toward Helmer Brook which marks the opposite boundary.

A fen occupies the low ground near the stream. Dominants here include *Cornus stolonifera* (red-osier dogwood) and *Solidago* spp. (goldenrod). The tract's upland portion supports a mesic prairie in which *Andropogon gerardii* (big bluestem), *Silphium terebinthinaceum* (prairie-dock), and *Lespedeza* sp. (bush clover) are common.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

44. Hemlock Research Natural Area

TYPE: natural area preserve

ACREAGE: 80

LOCATION: Sect. 2, T45N, R15W; Schoolcraft Co. (Seney National Wildlife Refuge).

PROTECTION: designation as Research Natural Area by U.S. Fish & Wildlife Service

DATE OF PROTECTION: 1948, September 21

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Seney National Wildlife Refuge

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve's topography consists of sandy, gently rolling glacial lakebed. *Tsuga canadensis* (hemlock) dominates most of the acreage and is joined in places by *Betula alleghaniensis* (yellow birch).

REFERENCE: Federal Committee on Ecological Reserves, 1977.

ADDRESS: Seney National Wildlife Refuge
Seney, MI 49883

45. Hoffmaster Natural Area

TYPE: natural area preserve

ACREAGE: 334

LOCATION: Sect. 36, T9N, R17W; Sect. 31, T9N, R16W; Muskegon Co. Sect. 1, T8N, R17W; Sect. 6, T8N, R16W; Ottawa Co.

PROTECTION: under Michigan's Wilderness and Natural Areas Act

DATE OF PROTECTION: 1979, December 13

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trails, stairway to overlook

MANAGEMENT: none

GENERAL CHARACTER: The preserve is dominated by high, wooded stable dunes, incised with deep blowouts. A narrow strip of foredune borders the sandy Lake Michigan Shore. Forests of *Acer saccharum* (sugar maple), *Fagus grandifolia* (beech), *Tsuga canadensis* (hemlock), and *Quercus* spp. (oak)

dominate the high dunes. On the foredune and blowouts, *Calamovilfa longifolia* (sand reed grass), *Ammophila breviligulata* (beach grass), and *Prunus pumila* (sand cherry) are common species.

Deer, red fox, skunk, and woodchuck have been observed on the site.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

46. Homer L. Hylton Memorial Plant Preserve

TYPE: natural area preserve

ACREAGE: 6

LOCATION: Sect. 27, T59N, R29W; Keweenaw Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1978, December 26

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: A companion property to the MNA's Keweenaw No. 2 Plant Preserve, this tract borders on Lake Superior with a rocky shore which supports the typical assemblage of boreal species, including *Arctostaphylos uva-ursi* (bearberry), *Primula mistassinica* (bird's-eye primrose), and *Potentilla tridentata* (cinquefoil). A shrub zone of *Shepherdia canadensis* (sheepberry), *Juniperus communis* (juniper), and *Vaccinium* spp. (blueberry) backs the open, rocky shore, and gives way to *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), and *Betula papyrifera* (paper birch).

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

47. Hoobler Natural Area (Pigeon River Preserve)

TYPE: natural area preserve

ACREAGE: 480

LOCATION: Sect. 1, T31N, R2W; Otsego Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1974, December 24

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: several dirt roads and foot trails

MANAGEMENT: none

GENERAL CHARACTER: A plain of sandy glacial outwash with low relief forms the topography of the preserve. The Pigeon River bisects the tract.

West of the river, conifer swamps of *Thuja occidentalis* (white-cedar), *Larix laricina* (tamarack), *Picea mariana* (black spruce), and *Abies balsamea* (balsam fir) prevail. Locally unforested uplands occur centrally, while wood-

lands of pine and mixed hardwoods generally occupy the higher ground east of the river. Common dominants here include *Pinus banksiana* (jack pine), *Pinus resinosa* (red pine), *Pinus strobus* (white pine), *Populus tremuloides* (quaking aspen), and *Betula papyrifera* (paper birch).

Wildlife reported from the area include deer, beaver, bear, osprey, woodcock, and partridge.

REFERENCE: Nature Conservancy, Michigan Field Office, 1978a.

ADDRESS: The Nature Conservancy

531 N. Clippert

Lansing, MI 48912

48. Horner Woods

TYPE: natural area preserve

ACREAGE: 22

LOCATION: Sect. 12, T2S, R6E; Washtenaw Co.

PROTECTION: deed restriction

DATE OF PROTECTION: 1965, April 25

OWNERSHIP: University of Michigan

ADMINISTRATION: Matthaei Botanical Gardens

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The preserve occupies an upland portion of interlobate moraine with locally rolling topography. A mixed hardwood forest of *Quercus alba* (white oak), *Quercus rubra* (red oak), *Carya* spp. (hickory), and some *Acer saccharum* (sugar maple) dominates the tract. A shallowly inundated depression is bordered by dead elms and a *Cornus* spp. (dogwood) thicket.

ADDRESS: Matthaei Botanical Gardens

1800 N. Dixboro Road

Ann Arbor, MI 48105

49. Huntington Memorial Plant Preserve

TYPE: natural area preserve

ACREAGE: 6

LOCATION: Sect. 7, T43N, R14W; Schoolcraft Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1969

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on a sloping upland near the Manistique River. *Betula papyrifera* (paper birch) and *Acer* spp. (maple) dominate the forest thereon.

REFERENCE: Holzman (pers. comm.).

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

50. Huron Islands Wilderness (formerly Huron Islands National Wildlife Refuge)

TYPE: natural area preserve

ACREAGE: 147

LOCATION: T53N, R29W; Marquette Co.

PROTECTION: under Federal Wilderness Act

DATE OF PROTECTION: 1970, October 23

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Seney National Wildlife Refuge

DEVELOPMENTS: inactive Coast Guard Station, lighthouse and boathouse

MANAGEMENT: none

GENERAL CHARACTER: The Huron Islands consist of 31 separate outcroppings of Precambrian granite in Lake Superior. Steep, 160-foot cliffs line the southern shores of the largest island, while on the north, east, and west, the dip of the rocks and glacial action have produced gentle slopes. Glacial striae are abundant on the exposed rock faces, and dikes lace the Precambrian granite.

Approximately two-thirds of the islands' area is forested; *Abies balsamea* (balsam fir), *Thuja occidentalis* (white-cedar), *Betula papyrifera* (paper birch), and *Pinus* spp. (pine) are major forest constituents. Along the shores, only lichens, low shrubs and herbs can persist.

About 75 bird and 8 small mammal species are present, including raven and snowshoe hare. Herring gulls are abundant, with nesting concentrated on the sparsely-vegetated easternmost islands.

REFERENCES: Corin, 1976; Dutton, 1968; U.S. Dep. Interior, [1967a].

ADDRESS: Seney National Wildlife Refuge

Seney, MI 49883

51. Huron Mountain Club Nature Research Area

TYPE: natural area preserve

ACREAGE: 17,700

LOCATION: T51-52N, R27-29W; Marquette Co.

PROTECTION: resolution by Huron Mountain Club

DATE OF PROTECTION: 1961, August 22

OWNERSHIP: Huron Mountain Club

ADMINISTRATION: Huron Mountain Club

DEVELOPMENTS: dirt roads, logging trails, foot trails, scattered residences

MANAGEMENT: none

GENERAL CHARACTER: Along the shore of Lake Superior, a plateau of Jacobsville sandstone extends inland for about a mile. At this point, Precambrian granite emerges abruptly, and the relief increases to 1000 feet above Lake Superior. Steep slopes form a rugged topography, and a number of lakes occupy pockets between the hills, with the largest (Mountain Lake) covering 810 acres.

The forests of the Huron Mountains are largely undisturbed, most of the acreage having undergone early selective cutting only in accessible areas. Hemlock and northern hardwood associations predominate, varying only in the relative abundances of constituent species. *Acer saccharum* (sugar maple) commonly dominates the hardwood forests and is often accompanied by *Betula alleghaniensis* (yellow birch), and *Tilia americana* (basswood). *Tsuga canadensis*

sis (hemlock) frequently forms pure stands on the mountain slopes. *Pinus resinosa* (red pine) thrives on the higher slopes and along the shores of mountain lakes.

The sandstone bluffs along Lake Superior support coniferous forests of *Picea glauca* (white spruce), *Tsuga canadensis* (hemlock), *Abies balsamea* (balsam fir), and *Pinus strobus* (white pine) with strong boreal affinities. Where dunes front on Lake Superior, they commonly support *Pinus banksiana* (jack pine) forests rich in lichens.

Successional forests of *Acer* spp. (maple), *Populus* spp. (aspen), and *Betula papyrifera* (paper birch) occupy cut-over areas, which comprise about one-quarter of the total preserve acreage. Old burn sites support forests of *Betula papyrifera* (white birch), *Populus grandidentata* (large-toothed aspen), *Acer* spp. (maple), and *Tsuga canadensis* (hemlock).

Bogs are of infrequent occurrence in the region. Two tracts of mature, forested bog—composed of *Picea mariana* (black spruce), *Larix laricina* (tamarack), and *Thuja occidentalis* (white-cedar)—lie near Lake Superior, and a floating bog mat borders Pony Lake.

Among the mammals present in the Huron Mountains, snowshoe hare, bear, beaver, and coyote are fairly common. Other common mammals include masked and short-tailed shrew, red-backed vole, woodland deer mouse, and least chipmunk. Gray squirrel, gray fox, and raccoon reach their northern dis-



51. Huron Mountain Club Nature Research Area

tributional limits in this area. Many common predator species were, however, eliminated in the club's early days, as were moose and caribou. Characteristically boreal birds, including the olive-sided flycatcher, Canada jay, spruce grouse, black-bearded woodpecker, raven, and bald eagle also occupy the preserve.

REFERENCES: Braun, 1950; Brubaker, 1975; Christy, 1929; Dodge, C. K., 1918; Dodge, P., 1961; Hagenah, 1963; Huron Mountain Club, 1967; Laundre, [1975]; Manville, 1948; Michigan Natural Areas Council, 1979a; Nichols, 1935, 1938; Wells & Thompson, [1976]; Willis & Coffman, [1975].

ADDRESS: Huron Mountain Wildlife Foundation
Huron Mountain Club
Big Bay, MI 49808

52. Isle Royale Wilderness

TYPE: natural area preserve

ACREAGE: 131,880

LOCATION: Isle Royale (Lake Superior); Keweenaw Co. (Isle Royale National Park).

PROTECTION: under Federal Wilderness Act

DATE OF PROTECTION: 1976, October 20

OWNERSHIP: U.S. Government

ADMINISTRATION: National Park Service, Isle Royale National Park

DEVELOPMENTS: foot trails, campsite shelters

MANAGEMENT: none

GENERAL CHARACTER: Isle Royale, on the northern rim of the Lake Superior Syncline, is composed of Keweenaw lava flows alternating with thinner beds of sandstone and conglomerate, all dipping southeast into Lake Superior. The igneous beds form most of the cuestaform ridges running the length of the island, the highest of which (Greenstone Ridge) rises to 490 feet above Lake Superior. The many swamps, lakes and fiord-like harbors occupy narrow valleys underlain by weaker sedimentary strata. Such valleys are largely the result of glacial quarrying. Glacial drift, however, is primarily restricted to the island's southwestern end, where it forms an extensive mantle. Several morainal features, oriented north-south, lie to the west and south of Lake Desor. Crag-and-tail drumlins are scattered northwest of Siskiwit Bay and trend westerly. Beach terraces of glacial lakes Minong and Nipissing are evident in the drift on the island's west end.

At least half of the island's vegetation shows disturbance from fire and/or logging. Although many communities are still successional, trends in vegetational development are clearly evident. Forests are primarily of two types—boreal coniferous and northern hardwood—each on the latitudinal fringe of its distribution. A linear vegetational zonation has developed, with hardwoods following the ridgetops and boreal forests lining the shores and valleys. On the island's periphery, where the cool, moist influence of the lake is greatest, the

boreal spruce-fir forest is dense, stunted and draped with *Usnea*. Frequent windthrow of conifers allows *Betula papyrifera* (paper birch) to invade. Inland, and at higher elevations, *Abies balsamea* (balsam fir) increases in relative abundance and the forest is taller and less dense.

Atop many of the ridges, especially in the southwest where soils are deep, forests of *Acer saccharum* (sugar maple) and *Betula alleghaniensis* (yellow birch) prevail. In young stands, *Populus* spp. (aspen) and *Betula papyrifera* (paper birch) are important. Also occurring intermittently on the high ridges are unforested areas, or "balds," maintained by lightning fires, erosion, and drought. Here, grasses share dominance with shrubs such as *Vaccinium angustifolium* (blueberry), *Diervilla lonicera* (bush honeysuckle), *Amelanchier* spp. (serviceberry), and *Corylus cornuta* (hazelnut), and scattered trees of *Betula papyrifera* (paper birch) and *Populus* spp. (aspen). Other communities of limited extent include *Thuja occidentalis* (white-cedar) swamps, *Pinus banksiana* (jack pine) woods, and floating bog mats.

In addition to the famous wolf and moose populations of Isle Royale, mink, red fox, beaver, muskrat, and snowshoe hare are among the common animals. Almost 200 bird species are known from the island.

REFERENCES: Allen, 1979; Brown, 1937; Cooper, 1913; Hansen et al., 1973; Hedrick & Lowe, 1936; Huber, 1973a, 1973b, 1975; Kapp, 1975; Krefting, 1966, 1974; Krefting et al., 1970; Mech, 1966; Peterson, 1977; Povah, 1935; Shelton, 1975; Thorpe & Povah, 1935; Wolff & Huber, 1973.

ADDRESS: Isle Royale National Park
87 N. Ripley St.
Houghton, MI 49931

53. James H. Klipfel Memorial Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 160

LOCATION: Sect. 35, T59N, R29W; Keweenaw Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1979, October 29

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Situated on the western end of Brockway Mountain, the preserve extends from the ridge-forming Middle Conglomerate, southward to the Lower Lake Shore Traps, spanning an elevation change of over 350 feet in less than one-half mile. Garden Brook flows through the tract's southern portion.

The upland part of the preserve is windswept and dominated largely by shrubs and small trees. Little vegetation manages to maintain itself on the steep southern slope of Brockway, but in the valley below, *Quercus rubra* (red oak), *Tilia americana* (basswood), and *Betula alleghaniensis* (yellow birch) give way to a conifer swamp of *Thuja occidentalis* (white-cedar), *Picea glauca* (white spruce), and *Abies balsamea* (balsam fir).

Brockway Mountain is frequented by migrating birds, especially in spring. Among those sighted are sharp-shin and broad-winged hawks, snowy owl, and bald and golden eagles.

REFERENCE: Michigan Nature Association, 1979b.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

54. Jonathan Woods

TYPE: natural area preserve

ACREAGE: 144

LOCATION: Sects. 30 & 31, T6N, R11E; Lapeer Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1978, July

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: foot trail system

MANAGEMENT: none

GENERAL CHARACTER: An interlobate moraine lends considerable relief to this preserve, with elevation varying up to 100 feet in its northern portion. A stream flows northward along the western boundary, cutting a valley deep into the glacial till.

Because of its habitat diversity, a relatively large number of communities exist within the preserve. The highest upland areas support a forest of mixed hardwoods in which *Quercus rubra* (red oak) and *Quercus alba* (white oak)



53. James H. Klipfel Memorial Nature Sanctuary (MNA)

predominate. On the lower uplands and in sheltered ravines, rich *Fagus grandifolia* (beech)-*Acer saccharum* (sugar maple) forests prevail. A sizeable stand of *Populus* sp. (aspen) lies on the tract's southern extreme, and old-field communities are occasional.

Of the three wetland communities present, one is a shrub-dominated kettle-hole bog and two are swamp forests, dominated respectively by *Betula alleghaniensis* (yellow birch) and *Larix laricina* (tamarack).

REFERENCE: Michigan Natural Areas Council. 1979a.

ADDRESS: The Nature Conservancy
531 N. Clippert
Lansing, MI 48912

55. Julius C. and Marie Moran Peter Nature Sanctuary (Grass Lake Nature Sanctuary)

TYPE: natural area preserve

ACREAGE: 95

LOCATION: Sect. 4, T31N, R9E; Sect. 33, T32N, R9E; Alpena Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1969, December 29

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: dirt road into property

MANAGEMENT: none

GENERAL CHARACTER: The Sanctuary is situated on the south end of Grass Lake, where the latter borders on a broad, marly marsh. In the adjoining upland, soils are thin or locally absent on the underlying Devonian Alpena Limestone.

A forest of *Thuja occidentalis* (white-cedar), *Picea glauca* (white spruce), and *Abies balsamea* (balsam fir) surrounds the lake. The marl marsh on the lake's periphery supports *Potentilla fruticosa* (shrubby cinquefoil), *Triglochin maritimum* (arrow-grass), *Sarracenia purpurea* (pitcher plant), *Utricularia cornuta* (bladderwort), and *Cladium mariscoides* (twig-rush).

Wildlife known from the preserve include bear, bobcat, coyote, loon,

American bittern, Wilson's snipe, and pileated woodpecker.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

56. Karl Chen Memorial Prairie Plant Preserve (Roy Road Prairie Plant Preserve)

TYPE: natural area preserve/managed preserve

ACREAGE: 30

LOCATION: Sect. 21, T8S, R12W; St. Joseph Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1976, October 19

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: limited burning of prairie

GENERAL CHARACTER: The preserve occupies a lowland area near the White Pigeon River. A small stream bisects the tract.

Most of the acreage supports a diversity of marsh and prairie species, including *Silphium terebinthinaceum* (prairie-dock), *Eupatorium* spp. (joe-pye-weed), *Veronicastrum virginicum* (Culver's root), and *Solidago* spp. (golden-rod). An upland oak "opening" lies along the preserve's eastern boundary.

Birds reported from the tract include bob-white and red-headed woodpecker.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

57. Kasey Hartz Natural Area

TYPE: natural area preserve

ACREAGE: 10

LOCATION: Sect. 15, T10N, R16W; Muskegon Co.

PROTECTION: resolution by Muskegon Community College Trustees

DATE OF PROTECTION: 1970, April 20

OWNERSHIP: Muskegon Community College

ADMINISTRATION: Life Science Department

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: A sandy plain of glacial outwash underlies the preserve. Four Mile Creek flows westward, cutting a valley through the property.

Quercus alba (white oak), *Quercus velutina* (black oak), and *Pinus strobus* (white pine) dominate the upland forest which covers most of the property. In the stream valley, a transitional *Prunus pensylvanica* (pin cherry)-*Populus* spp. (aspen) association gives way to *Osmunda cinnamomea* (cinnamon fern) and *Lindera benzoin* (spicebush) along the creek bed.

Mammals of the tract include raccoon, muskrat, and squirrel. Tufted titmouse, nuthatch, and flicker are among the resident birds.

REFERENCE: Michigan Natural Areas Council, 1979c.

ADDRESS: Life Sciences Department

Muskegon Community College

221 Quarterline Rd.

Muskegon, MI 49442

58. Keweenaw Shore No. 1 Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 37

LOCATION: Sect. 36, T59N, R30W; Keweenaw Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1967, October 7

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Located on the Outer Conglomerate along the Lake Superior shore, the preserve possesses a characteristic assemblage of shoreline species, including *Campanula rotundifolia* (bellflower), *Artemisia caudata* (wormwood), *Potentilla tridentata* (cinquefoil), and *Primula mistassinica* (bird's-eye primrose). The sparsely-vegetated rocks are backed by a shrub zone of *Shepherdia canadensis* (sheepberry), *Vaccinium angustifolium* (blueberry), *Alnus crispa* (alder), and *Juniperus communis* (juniper) which in turn gives way to an *Usnea*-draped, stunted forest of *Thuja occidentalis* (white-cedar), *Abies balsamea* (balsam fir), *Amelanchier* sp. (serviceberry), and *Betula papyrifera* (paper birch). Plant communities lying farther inland include *Thuja occidentalis* (white-cedar) swamp and open marsh.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043



58. Keweenaw Shore No. 1 Plant Preserve

59. Keweenaw Shore No. 2 Plant Preserve

TYPE: natural area preserve

ACREAGE: 6

LOCATION: Sect. 27, T59N, R29W; Keweenaw Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1978, November 27

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The dominant feature of this preserve is the rocky Lake Superior shoreline and its unique assemblage of plant species. On these lichen-encrusted rocks of the Outer Conglomerate formation are found *Primula mistassinica* (bird's-eye primrose), *Campanula rotundifolia* (bellflower), *Lathyrus maritimus* (beach pea), *Potentilla tridentata* (cinquefoil), *Solidago spathulata* (goldenrod), and, in moister rock hollows, *Pinguicula vulgaris* (butterwort). A shrub zone which backs the open shore consists of *Alnus crispa* (alder), *Shepherdia canadensis* (sheepberry), *Myrica gale* (sweet gale), and *Vaccinium angustifolium* (blueberry).

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

60. Kitchel Dunes (North Shore Dunes)

TYPE: natural area preserve

ACREAGE: 112

LOCATION: Sect. 20, T8N, R16W; Ottawa Co.

PROTECTION: ownership by The Nature Conservancy; dedication by Central Michigan University

DATE OF PROTECTION: 1974, December 18

OWNERSHIP: The Nature Conservancy (52 acres); Central Michigan University (60 acres)

ADMINISTRATION: The Nature Conservancy; Central Michigan University

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Composed largely of open, active dunes, the preserve supports a complex of sand ridges with intervening swales. The latter frequently hold dune pools, especially during high lake levels.

A limited area of upland dune is forested with *Tsuga canadensis* (hemlock), *Acer saccharum* (sugar maple), and *Fagus grandifolia* (beech). On the remaining upland acreage, *Ammophila breviligulata* (beach grass), *Calamovilfa longifolia* (sand reed grass), and *Prunus pumila* (sand cherry) dominate. The interdunal swales range in character from open water to localized marshes dominated

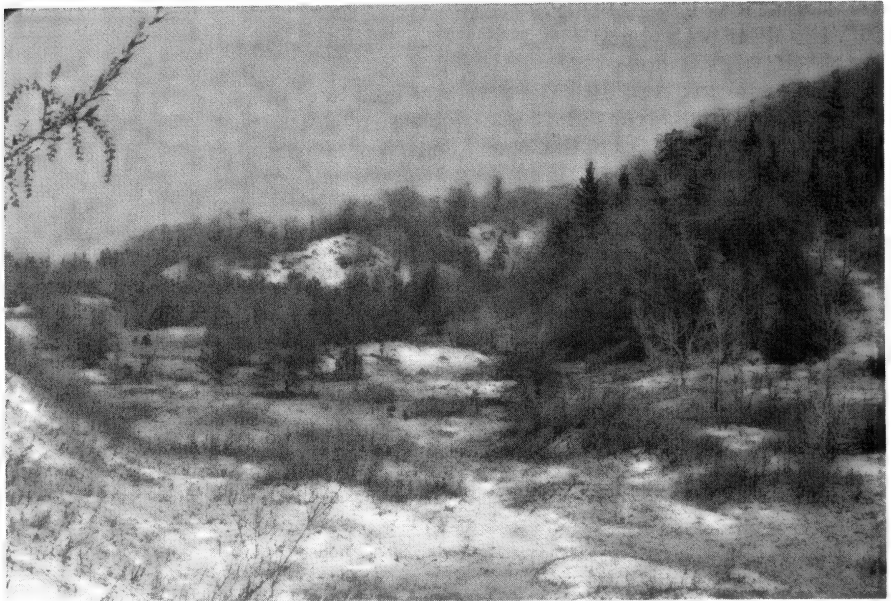
by *Scirpus americanus* (bulrush), *Juncus balticus* (rush), *Carex* spp. (sedge), and *Eleocharis* spp. (spike-rush). Older swales support stands of *Pinus banksiana* (jack pine).

REFERENCE: Urban and Environmental Studies Institute, 1977.

ADDRESSES: The Nature Conservancy

531 N. Clippert
Lansing, MI 48912

Central Michigan University
Mount Pleasant, MI 48859



60. Kitchel Dunes

61. Klumbis Road Prairie

TYPE: managed preserve

ACREAGE: 1.1

LOCATION: Sect. 22, T6S, R16W; Cass Co.

PROTECTION: legal agreement with The Nature Conservancy

DATE OF PROTECTION: 1978, December

OWNERSHIP: AMTRAK

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: none

MANAGEMENT: periodic burning and brush removal

GENERAL CHARACTER: A sandy, mesic prairie, the Klumbis Road site supports many components of both dry and mesic prairies, including *Andropogon gerardii* (big bluestem), *Andropogon scoparius* (little bluestem), *Cacalia atriplicifolia* (pale Indian plantain), *Phlox pilosa* (downy phlox), *Ratibida pinnata* (yellow coneflower), and *Senecio plattensis* (prairie ragwort).

REFERENCE: Michigan Natural Areas Council, 1978.

ADDRESS: The Nature Conservancy

531 N. Clippert
Lansing, MI 48912

62. Kope Kon Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 49

LOCATION: Sects. 16 & 21, T8S, R6W; Branch Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1979, October 25

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: short dirt road

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies adjacent to Lake George and includes an upland portion which slopes to lake level. The upland supports old fields, second growth hardwoods and an old growth *Quercus* spp. (oak) forest of very large stature. Nearer the lake, swamp hardwoods dominate, giving way to a *Typha* sp. (cattail) marsh on the lake's margin.

REFERENCE: Holzman (pers. comm.).

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

63. Lake Huron Sand Dunes Plant Preserve

TYPE: natural area preserve

ACREAGE: 16

LOCATION: Sect. 9, T41N, R3E; Chippewa Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1976, January 26

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve consists primarily of low, open and forested dunes in a complex of Nipissing beach terraces. Inland from the oldest of these terraces lies a poorly-drained till plain veneered by glacio-lacustrine sediments. A stream which parallels the Lake Michigan shore bisects the property.

The open dunes are dominated by beach grasses, *Arctostaphylos uva-ursi* (bearberry), *Juniperus communis* (juniper), and scattered stands of *Pinus strobus* (white pine) and *Pinus resinosa* (red pine). Inland from the stream, the dune ridges are forested with *Abies balsamea* (balsam fir), *Picea glauca* (white spruce), *Pinus* spp. (pine), and *Betula papyrifera* (paper birch). Between these ridges lie swales of *Thuja occidentalis* (white-cedar) swamp, and similar swamps dominate the low till plain to the north.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

64. Lake St. Clair National Wildlife Refuge

TYPE: natural area preserve

ACREAGE: 4200

LOCATION: T2N, R15E; St. Clair Co.

PROTECTION: designation as National Wildlife Refuge

DATE OF PROTECTION: 1934, September 13

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Shiawassee National Wildlife Refuge

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The Refuge consists largely of open water in the St. Clair River delta, marked only by buoys placed during duck hunting season. One permanent island dominated by *Typha* spp. (cattail) lies in the northern unit and others appear during low water years.

Established for waterfowl protection, the Refuge is used especially by migrating and overwintering ducks.

ADDRESS: Shiawassee National Wildlife Refuge

6975 Mower Rd., RR #1

Saginaw, MI 48601

65. Lake Superior Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 369

LOCATION: Sects. 4 & 9, T50N, R7W; Chippewa Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1969, July 1

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The sanctuary occupies an area shaped by the Nipissing Great Lakes; a parallel series of ancient beach ridges—running north-west to southeast—extend inland from the modern beach. The sandy ridge crests are forested with *Acer saccharum* (sugar maple) and *Tsuga canadensis* (hemlock), while the intervening swales support marshes and sphagnum bogs. A strip of open dune fronts on Lake Superior and supports *Hudsonia tomentosa* (beach-heath), *Lathyrus maritimus* (beach pea), *Ammophila breviligulata* (beach grass), and *Arctostaphylos uva-ursi* (bearberry).

The preserve provides habitat for bear, coyote, snowshoe hare, bobcat, and beaver. Birds sighted on the tract include barred owl, sandhill crane, parula, pileated woodpecker, and vireo.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043



65. Lake Superior Nature Sanctuary (Materna Studio, MNA)

66. Lakeville Swamp Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 66

LOCATION: Sect. 27, T5N, R11E; Oakland Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1963

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: Situated near the edge of a rolling interlobate moraine in northeastern Oakland County, the tract is a low-lying area with little internal relief. A small stream crosses its boundary in two places.

Five basic plant communities lie within the perimeter of the property, which consists of three separate parcels. Covering the eastern section and much of the central section are diverse wet prairie communities supporting *Andropogon gerardii* (big bluestem), *Sorghastrum nutans* (Indian grass), *Solidago* spp. (goldenrod), *Eupatorium* spp. (joe-pye weed), and *Cirsium muticum* (swamp thistle). A *Larix laricina* (tamarack) fen is surrounded by open marsh.

which gives way to *Thuja occidentalis* (white-cedar) swamp. Two other communities of limited extent are *Quercus* spp. (oak)-*Carya* spp. (hickory) "island" forest, and *Nemopanthus mucronatus* (Michigan holly) swamp.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

67. Lapland Buttercup Plant Preserve

TYPE: natural area preserve

ACREAGE: 20

LOCATION: Sect. 34, T43N, R2E; Chippewa Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1978, August 2

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on glacial lake sediments with very gently rolling topography. The highest areas of this rather low tract support rich *Acer rubrum* (red maple)-*Fraxinus nigra* (black ash) forests, while in the lower areas, coniferous swamps of *Thuja occidentalis* (white-cedar) and *Picea mariana* (black spruce) predominate.

REFERENCE: Kohring (pers. comm.).

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

68. Laughing Whitefish Falls Scenic Site

TYPE: natural area preserve

ACREAGE: 360

LOCATION: Sect. 16, T46N, R22W; Alger Co. (Laughing Whitefish Falls State Park).

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1963, June 14

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The Laughing Whitefish River drops over a thick, resistant sandstone formation, then cascades over a dome of thinly-bedded sandstone. Surrounding the falls is a mature *Tsuga canadensis* (hemlock)-*Pinus strobus* (white pine)-northern hardwood association with numerous large *Thuja occidentalis* (white-cedar) and *Picea mariana* (black spruce) bordering the river

below the falls. Nearer the tract's perimeter are successional woodlands dominated by *Acer* spp. (maple).

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909



68. Laughing Whitefish Falls Scenic Site (DNR)

69. Lawrence A. and Mary Bell Wade Memorial Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 72

LOCATION: Sect. 11, T3N, R16W; Allegan Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1979, November 3

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: two homes on property

MANAGEMENT: none

GENERAL CHARACTER: The preserve fronts on Silver Lake and on a small inlet stream which occupies a deep ravine in the sandy sediments. The tract's upland supports a forest of which *Fagus grandifolia* (beech), *Quercus* spp. (oak), *Tsuga canadensis* (hemlock), *Acer saccharum* (sugar maple), and *Pinus strobus* (white pine) are constituents. *Cornus florida* (flowering dogwood) is a prominent understory species.

REFERENCE: Daubendiek (pers. comm.).

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

70. Lawton Prairie

TYPE: managed preserve

ACREAGE: 2.2

LOCATION: Sect. 22, T3S, R13W; Van Buren Co.

PROTECTION: legal agreement with The Nature Conservancy

DATE OF PROTECTION: 1978, December

OWNERSHIP: AMTRAK

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: none

MANAGEMENT: periodic burning and brush removal

GENERAL CHARACTER: This site consists of mesic prairie on humusy sand and is dominated by *Andropogon gerardii* (big bluestem) and *Sorghastrum nutans* (Indian grass). Other species include *Solidago rigida* (stiff goldenrod), *Lespedeza capitata* (bush clover), *Liatris* spp. (blazing star), *Stipa spartea* (needle grass), and *Viola sagittata* (arrow-leaved violet).

REFERENCE: Michigan Natural Areas Council, 1978.

ADDRESS: The Nature Conservancy

531 N. Clippert

Lansing, MI 48912

71. Lefglen Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 175

LOCATION: Sects. 20, 21, 28, & 29, T3S, R2E; Jackson Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1970, December 28

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: Founded upon pitted glacial outwash, the Sanctuary possesses a varied topography, including two lakes of 8.9 and 2.5 acres respectively.

Most upland portions of the preserve are recovering from cultivation and support very young forests. However, one old-field has been colonized by many dry prairie species, with *Andropogon scoparius* (little bluestem) dominant. Lowland communities include hardwood swamp, *Larix laricina* (tamarack) swamp, and open marsh.

Veery, vireo, owl, bittern, sandhill crane, and woodcock are among the preserve's many bird species.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

72. Lew Sarrett Wildlife Sanctuary

TYPE: natural area preserve

ACREAGE: 170

LOCATION: Sects. 34 & 35, T3S, R18W; Berrien Co.

PROTECTION: ownership by Michigan Audubon Society

DATE OF PROTECTION: 1964

OWNERSHIP: Michigan Audubon Society

ADMINISTRATION: Michigan Audubon Society

DEVELOPMENTS: interpretive center, wildlife ponds, foot trails, teaching stations, observation towers

MANAGEMENT: none

GENERAL CHARACTER: Much of the preserve lies on the flood plain of the Paw Paw River where it traverses sandy glacio-lacustrine sediments. Topography is gently rolling.

The sole upland plant community is a mixed hardwoods forest dominated by *Liriodendron tulipifera* (tuliptree), *Quercus rubra* (red oak), *Fagus grandifolia* (beech), and *Fraxinus americana* (white ash). Of the lowland communities, only one is forested—a flood plain association of *Fraxinus nigra* (black ash), *Acer rubrum* (red maple), and *Platanus occidentalis* (sycamore). Unforested lowland communities include open marsh and shrub swamps.

REFERENCE: Lindsey & Escobar, 1976.

ADDRESS: Sarrett Nature Center

2300 Benton Center Rd.

Benton Harbor, MI 49022

73. Little Brevort Lake Scenic Site

TYPE: natural area preserve

ACREAGE: 540

LOCATION: Sects. 23, 24, & 25, T42N, R6W; Mackinac Co. (Mackinac State Forest).

PROTECTION: under Michigan's Wilderness and Natural Areas Act

DATE OF PROTECTION: 1979, May 10

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Forestry Division

DEVELOPMENTS: foot trail

MANAGEMENT: none

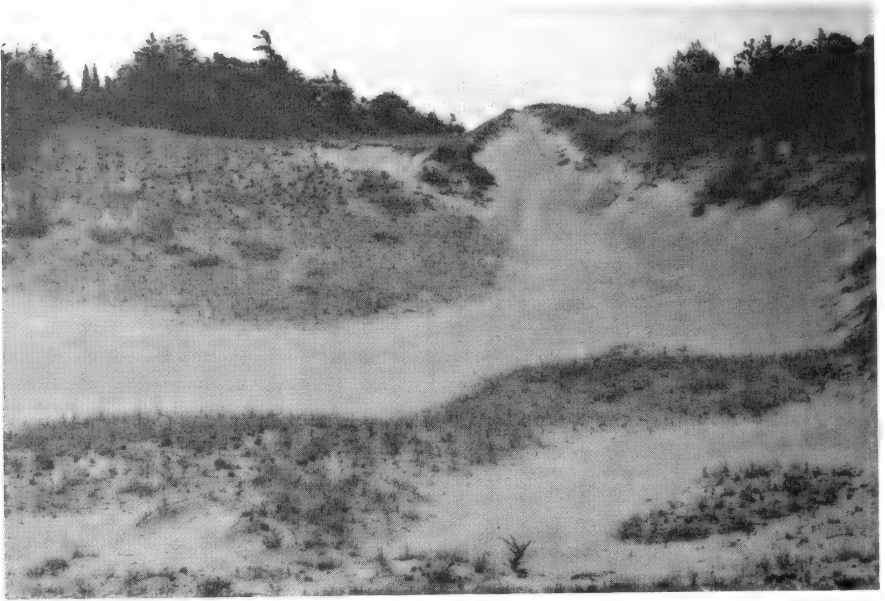
GENERAL CHARACTER: Little Brevort lake, itself covering 144 acres, lies on the Point Aux Chenes Formation atop a veneer of Pleistocene deposits. A low outwash plain north and east of the lake gives way on its south and west sides to high, rugged Nipissing dunes.

The dune ridges are wooded largely with forests of *Pinus strobus* (white pine), *Tsuga canadensis* (hemlock), and *Fagus grandifolia* (beech). Certain disturbed areas support stands of *Betula papyrifera* (paper birch) and *Tsuga canadensis* (hemlock). The low-lying outwash to the northeast is covered with swamp forest of *Thuja occidentalis* (white-cedar), *Tsuga canadensis* (hemlock), and *Betula alleghaniensis* (yellow birch).

ADDRESS: Michigan Dept. of Natural Resources

Forestry Division, Stevens T. Mason Bldg.

Lansing, MI 48909



75. Lucia K. Tower Nature Preserve (TNC)

74. Lost Lake Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 80

LOCATION: Sects. 13 & 24, T23N, R3E; Ogemaw Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1975, September 29

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on a till plain at the eastern edge of the Gladwin Moraine. Lost Lake, most of whose forty acres lie within the tract, is the most notable topographic feature. The north-east and south-central portions support upland forests of *Populus* sp. (aspen), *Acer saccharum* (sugar maple), and *Pinus strobus* (white pine). A cedar swamp occupies the center of the sanctuary and surrounds Lost Lake, which is immediately bordered by an open marsh. Common species in the marsh include *Sarracenia purpurea* (pitcher plant), *Carex* spp. (sedge), *Utricularia* sp. (bladderwort), and *Menyanthes trifoliata* (bog buckbean).

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

75. Lucia K. Tower Preserve

TYPE: natural area preserve

ACREAGE: 23

LOCATION: Sect. 21, T23N, R16W; Manistee Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1974, December 6

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: Five hundred feet of sandy Lake Michigan shoreline are included in the preserve property. Low dunes prevail near the lake and a seven to eight acre blowout extends inland to "Old Baldy," a 230-foot dune hill.

A typical sand flora occupies the low dunes and blowout area. Inland from the foredune area lies a mixed hardwood-conifer forest of *Acer saccharum* (sugar maple), *Fagus grandifolia* (beech), *Tsuga canadensis* (hemlock), and *Pinus strobus* (white pine).

REFERENCE: Kohring (pers. comm.).

ADDRESS: The Nature Conservancy
531 N. Clippert
Lansing, MI 48912

76. MacCurdy Ecological Tract

TYPE: natural area preserve

ACREAGE: 170

LOCATION: Sect. 34, T12N, R5W; Montcalm Co.

PROTECTION: dedication by Alma College

DATE OF PROTECTION: ca. 1965

OWNERSHIP: Alma College

ADMINISTRATION: Department of Biology

DEVELOPMENTS: foot trails, observation tower, research building

MANAGEMENT: none

GENERAL CHARACTER: The tract lies on a recessional moraine of the Saginaw lobe and possesses a rolling upland topography. The most notable geomorphic feature is a kettle-hole lake (Davis Lake) located in the center of the area.

The nearly 70 acres of upland forest on the preserve support secondary associations of varying composition. Dominants include *Populus* sp. (aspen)-*Quercus* spp. (oak) and *Acer* spp. (maple)-*Quercus rubra* (red oak)-*Fagus grandifolia* (beech). Scattered old fields represent many stages of secondary succession. An open bog mat borders the lake and merges with a *Picea mariana* (black spruce)-*Larix laricina* (tamarack) bog forest, in which *Acer rubrum* (red maple) and *Fraxinus* spp. (ash) are also important.

The preserve is inhabited by fox and various small mammals.

REFERENCES: MacDonald et al., 1971; Michigan Natural Areas Council, 1979a.

ADDRESS: Department of Biology
Alma College
Alma, MI 48801

77. Martha Mott Preserve

TYPE: natural area preserve

ACREAGE: 80

LOCATION: Sect. 36, T2S, R13W; Van Buren Co.

PROTECTION: ownership by Michigan Audubon Society

DATE OF PROTECTION: 1971

OWNERSHIP: Michigan Audubon Society

ADMINISTRATION: Michigan Audubon Society

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on glacial outwash which slopes uniformly to the south. Over one-third of the acreage is forested with *Quercus velutina* (black oak) and *Quercus alba* (white oak). Half the remaining area is open field, dominated by *Bromus inermis* (brome grass). A sandy ridge which bisects the northern portion was planted in the early 1960's with *Pinus* spp. (pines). A successional thicket of *Acer negundo* (boxelder), *Acer saccharum* (sugar maple), *Sassafras albidum* (sassafras), and *Prunus serotina* (black cherry) covers about twenty acres. The preserve also includes part of an extensive *Typha* sp. (cattail) marsh.

Numerous bird species nest in the preserve, including green heron, red-tailed hawk, yellow-billed cuckoo, and great horned owl.

REFERENCE: Good, 1977.

ADDRESS: Michigan Audubon Society

7000 N. Westnedge

Kalamazoo, MI 49001

78. Mary Stallins Ray Memorial Plant Preserve

TYPE: natural area preserve

ACREAGE: 8

LOCATION: Sect. 28, T7N, R16E; St. Clair Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1971, December

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: A plain of glacial lake clays lends the preserve a nearly level topography. The area is partly inundated each spring, and supports a lowland forest of *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Quercus* spp. (oak), and *Tsuga canadensis* (hemlock).

Birds reported from the area include whip-poor-will, ruffed grouse, woodcock, and ovenbird.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

79. McCormick Research Natural Area

TYPE: natural area preserve

ACREAGE: 3675

LOCATION: T50N, R29W, Marquette Co. (Ottawa National Forest).

PROTECTION: designation as Federal Research Natural Area by U.S. Forest Service

DATE OF PROTECTION: 1971

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Forest Service, Ottawa National Forest

DEVELOPMENTS: foot trail

MANAGEMENT: none



79. McCormick Research Natural Area (USFS)

GENERAL CHARACTER: A thin or spotty veneer of glacial till covers the Precambrian rocks underlying this area. The resultant topography is rolling to rugged, with elevations ranging from 1600 feet along the Yellow Dog River to over 1900 feet around Lake Margaret. Elevation changes of 200 feet in one-quarter mile are not uncommon. The Yellow Dog River flows northeasterly through the center of the tract and traverses two falls. A glacial moraine crosses the northern edge of the property.

The predominant forest types on the preserve are *Acer saccharum* (sugar maple)-*Fagus grandifolia* (beech)-*Betula alleghaniensis* (yellow birch) associations, or disturbed or xeric variants thereof. Concentrations of *Tsuga canadensis* (hemlock) are scattered throughout the area, as are *Pinus strobus* (white pine), *Betula papyrifera* (paper birch), and *Thuja occidentalis* (white-cedar). Bogs, marshes and alder swamps border the Yellow Dog River and surround small lakes and ponds. Other communities of occasional occurrence are dominated respectively by *Picea mariana* (black spruce), *Pinus resinosa* (red pine) and *Picea glauca* (white spruce)-*Abies balsamea* (balsam fir)-*Betula papyrifera* (paper birch).

Black bear, beaver, and red squirrels are common on the tract. Among the birds known from the area are pileated, downy, and hairy woodpeckers, gray jay, and raven.

REFERENCES: Brander et al., 1973; Federal Committee on Ecological Reserves, 1977; Raisanen & Werner, 1977; Robinson & Werner, 1975.

ADDRESS: North Central Forest Experiment Station
1030 Wright St.
Marquette, MI 49855

80. Michigan Islands Wilderness Area **(formerly Michigan Islands National Wildlife Refuge)**

TYPE: natural area preserve

ACREAGE: 251

LOCATION: Sect. 6 & 7, T38N, R12W; Sect. 17, T39N, R9W; Sect. 33, T40N, R8W; Charlevoix Co. Sect. 15, T29N, R9E; Alpena Co.

PROTECTION: under Federal Wilderness Act

DATE OF PROTECTION: 1970, October 23

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Shiawassee National Wildlife Refuge

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The Refuge consists of four islands—three from the Beaver Island archipelago in Lake Michigan and one in northern Lake Huron. Of the former group, Gull Island is the largest, covering about 239 acres. Its central portion is forested with *Abies balsamea* (balsam fir) and *Thuja occidentalis* (white-cedar). The rocky southern shore is irregular in outline, with numerous bays, inlets, and beach pools, but the remainder of the island is

bordered by a sandy shore fronting a low dune area. As its name implies, the island is heavily utilized by nesting gulls. Few mammals inhabit the island, but numerous other shore birds nest there.

Shoe and Pismire Islands, also in the Beaver Island group, consist of Pleistocene sands and gravels perched upon the dolomitic Bois Blanc Formation. The islands differ in their elevation above Lake Michigan. Shoe Island is submerged during high lake levels and supports only herbaceous vegetation, while part of Pismire is permanently emergent and supports a small forest community. The islands serve as nesting grounds for herring and ring-billed gulls, common and Caspian terns, and, on Pismire, mallards and red-breasted mergansers.

Scarecrow Island lies in Thunder Bay (Lake Huron) and is composed of Pleistocene deposits perched atop the Antrim shale formation. Beach pools litter the low, broad, gravel shore, while centrally the island is forested. Many bird species nest here, including those present on Shoe and Pismire, as well as great blue heron and cormorant.

REFERENCES: Dutton, 1968; Hatt et al., 1948; U.S. Dep. Interior, [1967b].

ADDRESS: Shiawassee National Wildlife Refuge

6975 Mower Rd. RR #1

Saginaw, MI 48601

81. Middle Belt Prairie

TYPE: managed preserve

ACREAGE: 11

LOCATION: Sect. 26, T4S, R9E; Wayne Co. (Lower Huron MetroPark).

PROTECTION: administrative designation by Huron-Clinton Metropolitan Authority

DATE OF PROTECTION: 1969, February

OWNERSHIP: Huron-Clinton Metropolitan Authority

ADMINISTRATION: Huron-Clinton Metropolitan Authority

DEVELOPMENTS: none

MANAGEMENT: periodic mowing

GENERAL CHARACTER: The preserve lies upon fluvial sediments in the Huron Slough, an abandoned channel of the Huron River. An open woodland, dominated by *Quercus rubra* (red oak) and *Quercus velutina* (black oak), occupies the tract's eastern portion. To the west, the forest thins to a mesic savannah with a dense ground cover which includes *Eupatorium* spp. (joe-pye-weed), *Vernonia missurica* (ironweed), *Rudbeckia* spp. (brown-eyed susan), and *Lespedeza* spp. (bush clover). Also present on the property is an old field, invaded to a degree by prairie species.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Huron-Clinton MetroParks

3050 Penobscot Bldg.

Detroit, MI 48226

82. Mixed Forest Nature Study Area

TYPE: natural area preserve

ACREAGE: 968

LOCATION: Sects. 6 & 7, Bois Blanc Island; Mackinac Co. (Black Lake State Forest).

PROTECTION: under Michigan's Wilderness and Natural Areas Act

DATE OF PROTECTION: 1977, December 23

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Forestry Division

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Located on Bois Blanc Island, the preserve lies upon Bois Blanc dolomite and borders on Lake Huron with a sandy to gravelly beach. *Betula papyrifera* (paper birch) and *Acer* spp. (maple) dominate the secondary forests of the tract. These stands vary in age and some possess very large, mature birch.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources

Forestry Division,

Stevens T. Mason Bldg.

Lansing, MI 48909

83. Mosely-Bennett-Barlow Preserve

TYPE: natural area preserve

ACREAGE: 45

LOCATION: Sect. 19, T3S, R8E; Wayne Co. Sect. 24, T3S, R7E; Washtenaw Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1975, December 27

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The Huron River flows through a former glacial lake bed of clay and silt in this preserve. Several old houses, cabins, and farm buildings lie along Rawsonville Road, which bisects the property. Swamp and marsh flood plain vegetation borders the Huron River and is backed by old fields and, to the northwest, a *Quercus* (oak)-*Carya* (hickory) forest.

REFERENCE: Mosely-Bennett-Barlow Stewardship Committee, 1979.

ADDRESS: The Nature Conservancy

531 N. Clippert

Lansing, MI 48912

84. Mud Lake Bog Research Area

TYPE: natural area preserve

ACREAGE: 200

LOCATION: Sects. 1 & 12, T1S, R5E; Washtenaw Co.

PROTECTION: deed restriction

DATE OF PROTECTION: 1957

OWNERSHIP: University of Michigan

ADMINISTRATION: Matthaei Botanical Gardens

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The central topographic feature of this preserve is an ice-block depression containing a bog lake. In the surrounding upland, isolated patches of *Quercus* spp. (oak)-*Carya* spp. (hickory) forest are scattered through old-field communities dominated by *Crataegus* spp. (hawthorn) and *Rhus typhina* (staghorn sumac). Lowland communities cover most of the preserve's acreage, and consist largely of open marsh and hardwood swamp. *Larix laricina* (tamarack) swamp surrounds the lake, which is immediately bordered by an extensive floating sphagnum-sedge mat.

REFERENCES: Getz, 1961a,b,c; Heatwole & Getz, 1960; Pennington, 1906.

ADDRESS: Matthaei Botanical Gardens

1800 N. Dixboro Road

Ann Arbor, MI 48105

85. Newaygo Prairie Ecological Study Area

TYPE: natural area preserve

ACREAGE: 80

LOCATION: Sect. 35, T12N, R12W, Newaygo Co. (Manistee National Forest).

PROTECTION: special designation by U.S. Forest Service

DATE OF PROTECTION: 1966, January

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Forest Service, Manistee National Forest

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on a level plain of sandy glacial outwash. Soil in the area consists of Sparta loamy sand, a common substrate of prairie sites in Newaygo County. Vegetation here is dominated by dry prairie species such as *Andropogon scoparius* (little bluestem), *Carex pensylvanica* (sedge), and *Rubus* sp. (blackberry). Other common species include *Koeleria macrantha* (junegrass), *Aristida purpurascens* (purple three-awn), and *Rumex acetosella* (sheep sorrel).

REFERENCE: Hauser, 1953.

ADDRESS: District Forester

Manistee National Forest

White Cloud, MI 49349



86. Newaygo Prairie Plant Preserve

86. Newaygo Prairie Plant Preserve

TYPE: natural area preserve

ACREAGE: 110

LOCATION: Sects. 2 & 11, T12N, R12W; Newaygo Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1969, August 21

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on a glacial outwash plain at the northern edge of Michigan's "prairie peninsula." The tract occupies a broad, bowl-like depression which lends it limited relief. Soils are typically Sparta loamy sand.

Similar to other prairie tracts in Newaygo County, this land has reverted to its original prairie condition since abandonment as farmland in the late 1800's. Oak woods surround the open prairie, which is dominated by *Andropogon scoparius* (little bluestem), *Carex pensylvanica* (sedge), and *Rubus* sp. (blackberry). Other common species here include *Opuntia humifusa* (prickly-pear), *Tephrosia virginiana* (goat-rue), and *Artemisia caudata* (wormwood).

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

87. Newton Woods

TYPE: natural area preserve

ACREAGE: 40

LOCATION: Sect. 29, T5S, R14W; Cass Co.

PROTECTION: resolution by Department of Forestry, MSU

DATE OF PROTECTION: ca. 1976

OWNERSHIP: Michigan State University

ADMINISTRATION: Department of Forestry

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: The tract is situated on a plain of glacial outwash within the Kalamazoo morainic complex. Dowagiac Creek flows through the property's southeast quarter.

A rich, old-growth hardwood forest covers the area. Dominants here are *Acer saccharum* (sugar maple) and *Fagus grandifolia* (beech), contrary to a report of *Quercus alba* (white oak) dominance by Lindsey and Escobar (1976). In addition, the forest includes some unusually large individuals of *Liriodendron tulipifera* (tuliptree), *Quercus bicolor* (swamp white oak), and *Quercus velutina* (black oak).

REFERENCES: Hollensen (pers. comm.); Lindsey & Escobar, 1976.

ADDRESS: Department of Forestry
Michigan State University
East Lansing, MI 48824

88. Northern Hardwoods Public Use Natural Area

TYPE: natural area preserve

ACREAGE: 68

LOCATION: Sect. 13, T44N, R14W, Schoolcraft Co. (Seney National Wildlife Refuge).

PROTECTION: designation as Public Use Natural Area by U.S. Fish & Wildlife Service

DATE OF PROTECTION: 1977, March 16

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Seney National Wildlife Refuge

DEVELOPMENTS: gravel road through northern portion

MANAGEMENT: none

GENERAL CHARACTER: Wind and wave action has shaped the glacial lake sands deposited here by Lake Algonquin into low, scattered ridges. An old-growth hardwood forest of *Fagus grandifolia* (beech) and *Acer saccharum* (sugar maple) dominates the tract. *Betula alleghaniensis* (yellow birch), *Betula papyrifera* (paper birch), and *Tsuga canadensis* (hemlock) are common associates. Approximately 16 acres support a *Pinus resinosa* (red pine) stand.

Wildlife species frequenting the area include pileated woodpecker, barred owl, and flying squirrel.

ADDRESS: Seney National Wildlife Refuge
Seney, MI 49883

89. Northern Hardwood Research Natural Area

TYPE: natural area preserve

ACREAGE: 550

LOCATION: Sects. 4 & 9, T44N, R13W, Schoolcraft Co. (Seney National Wildlife Refuge)

PROTECTION: designation as Research Natural Area by U.S. Fish & Wildlife Service

DATE OF PROTECTION: 1948, September 21

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Seney Nat. Wildlife Refuge

DEVELOPMENTS: gravel road, goose pen impoundment

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on the sandy former bed of glacial Lake Algonquin and is characterized by flat upland and low dunes. The Manistique River bisects the area's southern portion. *Acer saccharum* (sugar maple), *Fagus grandifolia* (beech), and *Betula alleghaniensis* (yellow birch) dominate the old-growth forest which covers most of the site.

Deer, bear, and numerous small mammals are known from the preserve.

REFERENCE: Federal Committee on Ecological Reserves, 1977.

ADDRESS: Seney National Wildlife Refuge
Seney, MI 49883

90. Northshore Research Natural Area

TYPE: natural area preserve

ACREAGE: 817

LOCATION: Sects. 5 & 6, Bois Blanc Island; Mackinac Co. (Black Lake State Forest).

PROTECTION: under Michigan Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1955, December 9

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Forestry Division

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The peninsular portion of section 5 lies upon the Silurian dolomite of the St. Ignace Formation. To the south, the Bois Blanc Formation, which comprises the bulk of the island, consists of Devonian dolomite interbedded with chert. Glacial deposits are thin or insignificant.

The tract supports a well-developed forest partly dominated by *Pinus strobus* (white pine), with numerous individuals exceeding 20 inches in diameter. Also of importance are *Pinus resinosa* (red pine), *Abies balsamea* (balsam fir), *Picea* spp. (spruce) and *Thuja occidentalis* (white cedar).

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Forestry Division, Stevens T. Mason Bldg.
Lansing, MI 48909

91. Osborne Mills Riverland Preserve

TYPE: natural area preserve

ACREAGE: 39

LOCATION: Sect. 11, T2S, R5E; Washtenaw Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1976, July

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The preserve borders an oxbow of the Huron River.

On its erosional bank, the river has cut deeply into an interlobate moraine to produce steep slopes with local seepage.

A well-developed *Quercus* (oak)-*Carya* (hickory) forest dominates the tract's upland. Wetland communities occupy the narrow floodplain along the oxbow's outer bank and the entire inner bank. A triangle of old field lies on the tract's northern end.

Opossum, woodchuck, muskrat, weasel, and red fox inhabit the preserve, and birds sighted there include great blue heron, osprey, blackbilled cuckoo, and screech owl.

REFERENCE: Washtenaw Land Conservancy, 1978.

ADDRESS: The Nature Conservancy

511 N. Clippert

Lansing, MI 48912

92. Palmer-Wilcox-Gates Preserve

TYPE: natural area preserve

ACREAGE: 15

LOCATION: Sect. 9, T29N, R9W; Antrim Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1976, November 17

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The shoreline of this tract, located on the east side of Grand Traverse Bay, consists of a low foredune backed by fossil dunes up to 35 feet in height. An interdunal swale enters the eastern border.

With the exception of the foredune, which supports typical open dune vegetation, the upland is forested with a northern mixed hardwoods association in which *Fagus grandifolia* (beech), *Betula alleghaniensis* (yellow birch), *Tsuga canadensis* (hemlock), *Acer saccharum* (sugar maple), and *Pinus* spp. (pine) share dominance. The swale area consists of open marsh.

The spotted sandpiper, pileated woodpecker, veery, thrush, and ovenbird have been sighted on the preserve. Gray squirrel, raccoon, skunk, and red fox are also characteristic of the area.

REFERENCE: Nature Conservancy, Michigan Field Office, 1978b.

ADDRESS: The Nature Conservancy

531 N. Clippert

Lansing, MI 48912

93. Passage Island Research Natural Area

TYPE: natural area preserve

ACREAGE: 104

LOCATION: Keweenaw Co., Isle Royale National Park

PROTECTION: designation as Research Natural Area by National Park Service

DATE OF PROTECTION: 1966

OWNERSHIP: U.S. Government

ADMINISTRATION: National Park Service, Isle Royale National Park

DEVELOPMENTS: the 1-acre lighthouse site on Passage Island is not included in the Natural Area.

MANAGEMENT: none

GENERAL CHARACTER: The island's geomorphic character is identical to that of Isle Royale (see Isle Royale Wilderness). Vegetation, however, differs from that of the main island in the absence of *Rubus parviflorus* (thimbleberry) and the luxuriance of *Taxus canadensis* (yew) and other shrubs, for there is no browsing by moose, which are not present on the island. The timber wolf is also absent from the island.

REFERENCES: (see also Isle Royale references): Federal Committee on Ecological Reserves, 1977.

ADDRESS: Isle Royale National Park
87 N. Ripley St.
Houghton, MI 49931

94. Pennfield Bog Plant Preserve

TYPE: natural area preserve

ACREAGE: 29

LOCATION: Sect. 11, T1S, R7W; Calhoun Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1967, February 28

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve is located in an ice block depression on the Kalamazoo moraine and is surrounded by rolling upland. Nearly all the acreage lies in the water-filled depression of Little Goose Lake, which supports a floating bog mat. The advancing edge of the mat is dominated by *Decodon verticillatus* (swamp loosestrife) which is backed by a community of *Carex lasiocarpa* (sedge), *Vaccinium macrocarpon* (cranberry), *Thelypteris palustris* (marsh fern), and *Chamaedaphne calyculata* (leatherleaf). A swamp forest of *Larix laricina* (tamarack) surrounds the open mat, and a low-lying *Acer rubrum* (red maple) forest occupies the rim of the depression.

REFERENCES: Crow, 1969a, b, c; Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

95. Pepperidge Dunes Plant Preserve

TYPE: natural area preserve

ACREAGE: 20

LOCATION: Sect. 15, T7S, R20W; Berrien Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1979, June 25

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

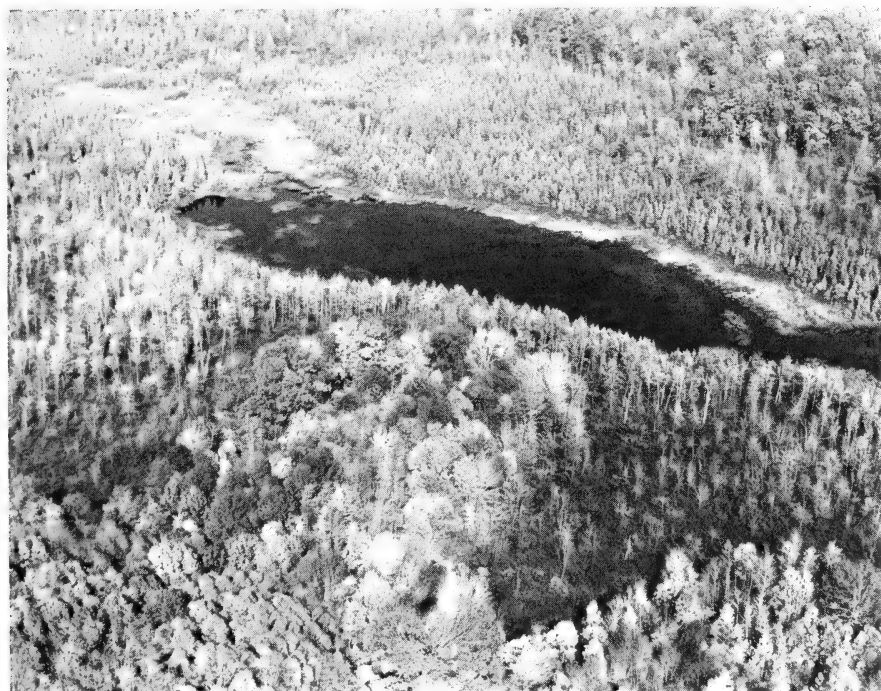
GENERAL CHARACTER: The preserve derives its name partly from the fossil beach upon which it lies, producing a level upland. A forest of *Acer rubrum* (red maple) and associated species—including *Nyssa sylvatica* (pepperidge)—dominates the tract.

REFERENCE: Kohring (pers. comm.).

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043



94. Pennfield Bog Plant Preserve (R. Holzman, MNA)

96. Petersburg State Game Area Special Habitat

TYPE: managed preserve

ACREAGE: 10

LOCATION: Sect. 15, T7S, R6E; Monroe Co. (Petersburg State Game Area).

PROTECTION: special designation by Wildlife Division, Michigan DNR

DATE OF PROTECTION: 1979

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Wildlife Division

DEVELOPMENTS: none

MANAGEMENT: periodic burning

GENERAL CHARACTER: The tract consists of sandy, mesic prairie strips on either side of Teal Road. *Andropogon scoparius* (little bluestem) and *Andropogon gerardii* (big bluestem) dominate, and common forbs include *Liatris* spp. (blazing star), *Desmodium canadense* (tick trefoil), and *Lespedeza capitata* (bush clover).

ADDRESS: Michigan Dept. of Natural Resources
Wildlife Division, Stevens T. Mason Bldg.
Lansing, MI 48909

97. Phyllis Haehnle Memorial Sanctuary

TYPE: natural area preserve/managed preserve

ACREAGE: 687

LOCATION: Sects. 1, 2, & 3, T2S, R1E; Jackson Co.

PROTECTION: ownership by Michigan Audubon Society

DATE OF PROTECTION: 1955

OWNERSHIP: Michigan Audubon Society

ADMINISTRATION: Michigan Audubon Society

DEVELOPMENTS: crane observation area

MANAGEMENT: strip crops planted for wildlife food and cover

GENERAL CHARACTER: The preserve lies on a low, sandy glacial outwash plain, and much of the acreage is at or below the water table. Part of Eagle Lake lies within the tract's boundary. Forest associations are of three types: *Quercus* (oak)-*Carya* (hickory), *Fagus grandifolia* (beech)-*Acer saccharum* (sugar maple), and *Populus* spp. (aspen). Open marsh occupies extensive areas; dominants here are *Typha latifolia* (cattail) and *Scirpus* spp. (bulrush). Several old fields are planted with strip crops for wildlife food and cover.

Bird life of the Sanctuary is diverse. Among the nesting species are Canada goose, sandhill crane, coot, and American and least bittern. Migratory visitors include up to 700 sandhill cranes, many ducks and geese, and occasional whistling swans.

REFERENCES: Walkinshaw, 1973; Whiting (pers. comm.); Wing, 1955.

ADDRESS: Michigan Audubon Society
7000 N. Westnedge
Kalamazoo, MI 49001

98. Pine River Nature Sanctuary (Stephen M. Polovich Memorial)

TYPE: natural area preserve

ACREAGE: 18

LOCATION: Sect. 30, T7N, R16E; St. Clair Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1963

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The tract lies atop delta sediments from the post-glacial Black River, which have now been dissected by the modern river and its tributaries, creating a diverse topography of uplands and broad ravines. The forest occupying the site is one of transition between northern and southern associations. Dominants include *Fagus grandifolia* (beech), *Betula alleghaniensis* (yellow birch), *Acer saccharum* (sugar maple), and *Tsuga canadensis* (hemlock).

Whip-poor-will and great horned owl are among the many birds known from the area.

REFERENCES: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043



99. Porcupine Mountains Wilderness Area

99. Porcupine Mountains Wilderness Area

TYPE: natural area preserve

ACREAGE: 42,246

LOCATION: T50N, R45W; Gogebic Co. T50N, R44W; T51N, R43W; Ontonagon Co. (Porcupine Mountains Wilderness State Park).

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1954, August 13

OWNERSHIP: State of Michigan

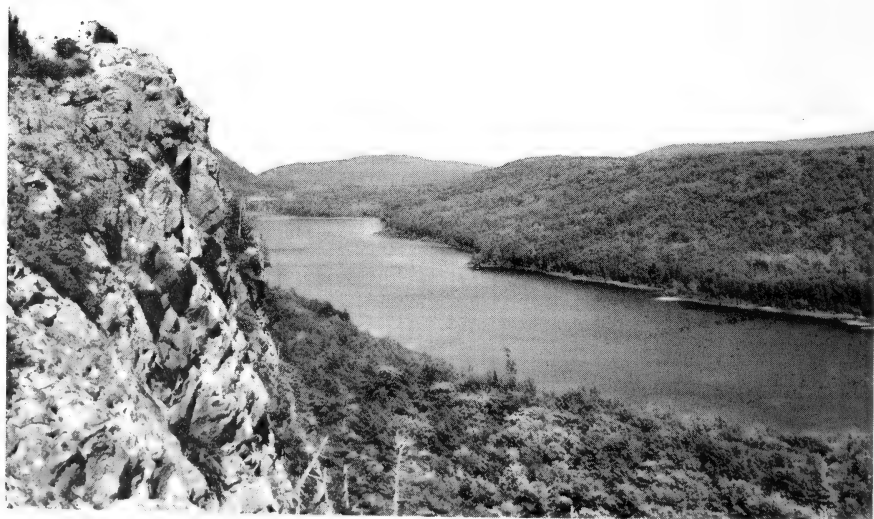
ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trail system, cabins, and trailside shelters

MANAGEMENT: none

GENERAL CHARACTER: The Porcupines lie on the southern edge of the lake Superior Syncline and are formed of alternating beds of volcanics and conglomerates, dipping northwest into the Superior Basin. The resistant formations produce ridges which are flanked by valleys of weaker rock layers. This phenomenon is demonstrated most dramatically along the area's northern extreme, where the low Superior shoreline is backed by the Outer or Great Conglomerate, which rises 900 feet, then gives way in a 400-foot escarpment to the valley containing Lake of the Clouds and Carp Creek. To the south, this pattern is echoed twice more in subdued form, producing the "mountainous" topography of the Porcupines. Glacial drift is thin or absent on the hilltops, but occurs in varying thicknesses on the lower slopes and valleys.

The area is well known for its vegetation; it supports the most extensive virgin hardwood forest in eastern North America west of the Adirondacks. The forest is dominated over most of its area by *Acer saccharum* (sugar maple), mingling with *Tilia americana* (basswood), *Tsuga canadensis* (hemlock), and



99. Porcupine Mountains Wilderness Area (J. Roethele, DNR)

Betula alleghaniensis (yellow birch). On north-facing slopes, hemlock often moves into dominance and, in places, occurs in almost pure stands. *Pinus strobus* (white pine) is important on steep, rocky slopes. Pioneer communities of *Arctostaphylos uva-ursi* (bearberry), *Vaccinium* sp. (blueberry), and dwarfed *Pinus* spp. (pine) occur along the crest and cliffs of the front range, giving way to *Quercus* (oak)-*Populus* (aspen) forests. Swamps of *Thuja occidentalis* (white-cedar), *Larix laricina* (tamarack), *Picea glauca* (white spruce), and *Fraxinus nigra* (black ash) occupy the flood plains of Carp Creek and other streams.

A forest of *Populus* spp. (aspen) and *Betula papyrifera* (paper birch) lies between Lake Superior and M-107, the result of fire within the last fifty years. Also scattered throughout the region are sprout forests of *Acer saccharum* (sugar maple), *Tilia americana* (basswood), *Betula alleghaniensis* (yellow birch), and *Quercus rubra* (red oak), occupying areas once clear-cut.

Common mammals in the region include bear, beaver, deer, and red squirrel.

REFERENCES: Braun, 1950; Darlington, 1931, 1937; Michigan Natural Areas Council, 1979a; Nichols & Steere, 1937; Ruthven et al., 1906.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

100. Port Huron State Game Area Special Habitats

TYPE: natural area preserve

ACREAGE: 770

LOCATION: Sects. 5, 6, 15-17, 21, 22, 26, & 27, T7N, R16E, St. Clair Co. (Port Huron State Game Area).

PROTECTION: special designation by Wildlife Division, Michigan DNR

DATE OF PROTECTION: 1977

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Wildlife Division

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Seven separate tracts are included in the Special Habitat designation. All lie on or near the Black River, which cuts a steep-sided ravine through sandy, glacio-lacustrine sediments. Three of the tracts include *Tsuga canadensis* (hemlock) stands and one supports a mixed conifer forest. Another tract contains deep, forested ravines, and the remaining sites include a rich swamp forest and a combination of old stream beds, floodplain, and bluffs.

Fox, deer, mink, beaver, and weasel are among the many mammal species present. Birds of the area include northern warblers, scarlet tanager, and blue-gray gnatcatcher.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Wildlife Division, Stevens T. Mason Bldg.
Lansing, MI 48909

101. Prairie Chicken Management Area

TYPE: managed preserve

ACREAGE: 1031

LOCATION: Sects. 2, 3, 10, & 14, T20N, R7W; Osceola Co.

PROTECTION: special designation by Natural Resources Commission

DATE OF PROTECTION: 1970

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Wildlife Division

DEVELOPMENTS: observation blind

MANAGEMENT: maintenance of nesting and brood cover, controlled burning, mowing, and planting of grasses and food patches

GENERAL CHARACTER: The preserve is maintained in an open, prairie-like condition, with trees and high brush largely eliminated. Food patches include corn, buckwheat, millet, oats, and wheat. A small but fluctuating population of prairie chickens is currently being maintained.

REFERENCE: Ammann, 1957.

ADDRESS: Michigan Dept. of Natural Resources
Wildlife Division, Stevens T. Mason Bldg.
Lansing, MI 48909

102. Prairie Chicken Nature Sanctuary

TYPE: managed preserve

ACREAGE: 47

LOCATION: Sect. 3, T20N, R7W; Osceola Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1971, May 13

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

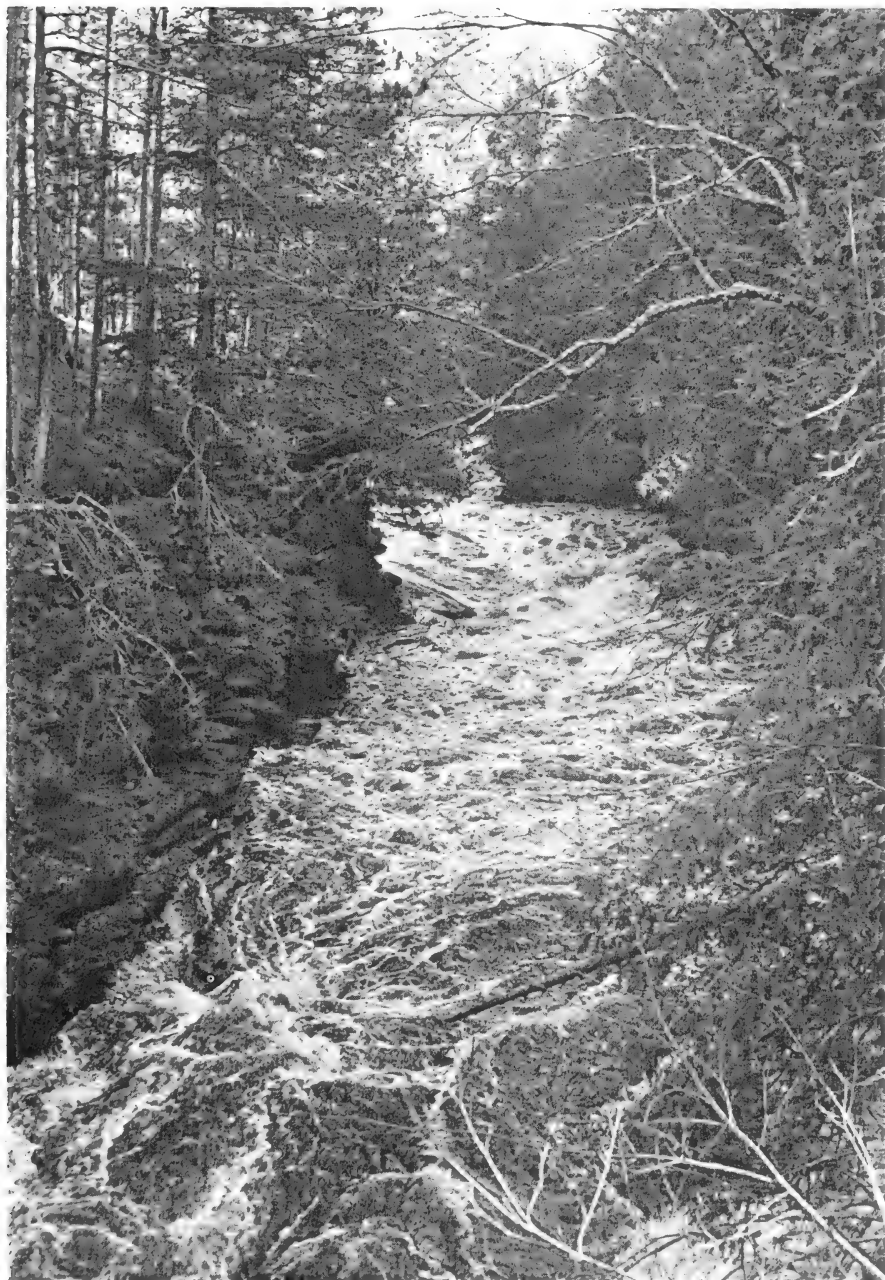
MANAGEMENT: maintenance of nesting and brood cover, controlled burning, mowing and planting of grasses and food patches

GENERAL CHARACTER: The preserve occupies a flat, sandy plain with local depressions. Vegetation is mostly open and dominated by *Danthonia spicata* (poverty oatgrass) and *Pteridium aquilinum* (bracken). *Betula papyrifera* (paper birch) and *Populus tremuloides* (quaking aspen) occur in scattered clumps. Sedge marshes occupy the local depressions.

The area is contiguous with the DNR's Prairie Chicken Management Area, which supports a small population of prairie chickens. Other bird life of the MNA preserve includes American bittern, upland plover, northern yellow-throat, and song sparrow.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043



103. Presque Isle River Scenic Site (J. Roethele, DNR)

103. Presque Isle River Scenic Site

TYPE: natural area preserve

ACREAGE: 1465

LOCATION: Sects 4 & 5, T49N, R45W; Sects. 19, 20, 29-32, T50N, R45W; Gogebic Co. (Porcupine Mountains Wilderness State Park).

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1954, August 13

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: The Presque Isle River flows over the Nonesuch shale here in its lower reaches. Traversing a series of low falls and cascades, it then divides into two swifter and narrower channels, cut deeply into the bedrock. Its dark waters empty into Lake Superior along a sandy beach built of the stream's own sediment. *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), and *Tsuga canadensis* (hemlock) dominate the forest in the area near the falls.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

104. Proud Lake Nature Study Area

TYPE: natural area preserve

ACREAGE: 105

LOCATION: Sect. 21, T2N, R8E; Oakland Co. (Proud Lake Recreation Area).

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1966, March 8

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: Located upon a pitted outwash plain, the area's outstanding feature is a deep ice-block depression housing a bog lake with a quaking mat. A smaller, shallower lake (Hidden Lake) lies in the east-central portion of the tract and has marshy borders. Both lakes are surrounded by well-drained upland.

A combination of *Quercus* (oak)-*Carya* (hickory) forest and old-field communities occupies the uplands. Swamp forests of *Fraxinus nigra* (black ash), *Quercus bicolor* (swamp white oak), *Tilia americana* (basswood), *Acer rubrum* (red maple), and *Ulmus rubra* (slippery elm) surround the lake-border communities. On the bog mat proper, a *Larix laricina* (tamarack)-*Toxicodendron vernix*

(poison sumac) swamp backs an open sphagnum-sedge community, supporting many typical herbaceous and shrubby bog species.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

105. Purple Coneflower Plant Preserve

TYPE: natural area preserve

ACREAGE: 21

LOCATION: Sect. 28, T43N, R5W; Mackinac Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1969, July 28

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: This unforested tract on the Niagaran Cuesta supports a probably introduced population of *Echinacea pallida* (purple coneflower), a Midwest and Great Plains prairie species. Among the other common plants are *Anaphalis margaritacea* (pearly everlasting), *Monarda fistulosa* (wild bergamot), and *Hypericum perforatum* (St. John's-wort).

Flicker, kingbird, catbird, indigo bunting, and goldfinch are a few of the birds reported from the preserve.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

106. Rare Fern Plant Preserve

TYPE: natural area preserve

ACREAGE: 25

LOCATION: T43N, R2W; Mackinac Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1979, May 9

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Located on the dolomitic Niagaran Cuesta, the area contains numerous rocky escarpments and outcroppings. The preserve supports

a rich *Acer saccharum* (sugar maple) forest in which shade- and moisture-loving mosses and ferns abound. Among the many ferns present are *Polystichum lonchitis* (holly fern), *Adiantum pedatum* (maidenhair fern), and *Asplenium trichomanes* (maidenhair spleenwort).

Bear, raven, snowy owl, and pileated woodpecker are reported from the general area.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

107. Rattlesnake Master Plant Preserve

TYPE: natural area preserve

ACREAGE: 3

LOCATION: Sect. 15, T5S, R11W; St. Joseph Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1977, March 22

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: dirt road into property

MANAGEMENT: none

GENERAL CHARACTER: This small preserve is situated on glacial outwash with level topography. Vegetation consists of very open *Quercus velutina* (black oak)-*Prunus serotina* (black cherry) woodland, and the preserve derives its name from the relative abundance of *Eryngium yuccifolium* (rattlesnake master). Other important herbaceous and shrubby species include *Andropogon scoparius* (little bluestem), *Carex bicknellii* (sedge), *Danthonia spicata* (poverty grass), *Ceanothus americanus* (New Jersey-tea), and *Lespedeza* sp. (bush clover).

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

108. Red Pine Research Natural Area

TYPE: natural area preserve/managed preserve

ACREAGE: 640

LOCATION: Sects. 11-14, T44N, R14W; Schoolcraft Co.

PROTECTION: designation as Research Natural Area by U.S. Fish & Wildlife Service

DATE OF PROTECTION: 1948, September 21

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Seney National Wildlife Refuge

DEVELOPMENTS: dirt road, waterfowl impoundment

MANAGEMENT: waterfowl management on impoundment

GENERAL CHARACTER: The sandy former bed of glacial Lake Algonquin forms the basic topography of this preserve. An upland plateau occupies most of the acreage west of the Driggs River, which bisects the property. Adjacent to and east of the river, the water table is at or near the surface, and "T Pool West," a Refuge waterfowl impoundment, lies in this area.

Pine forests cover the upland 200 acres of the preserve, with half dominated by *Pinus resinosa* (red pine) and half by *Pinus banksiana* (jack pine). A portion of muskeg invades the tract's western boundary, but all other wetlands lie along the river itself—where shrub and *Picea* (spruce) swamps prevail—or to the east, where T-Pool is surrounded by open marsh.

Deer, bear, small mammals, and various waterfowl are reported from the area.

REFERENCE: Federal Committee on Ecological Reserves, 1977.

ADDRESS: Seney National Wildlife Refuge
Seney, MI 49883

109. Red Wing Acres Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 40

LOCATION: Sect. 17, T8N, R13E; St. Clair Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1960, December 10

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The tract lies on a sandy glacial lake-bed once occupied by cranberry marsh. However, drainage, peat fires, and cultivation in the early 1900's have left a combination of mesic *Populus* (aspen) woodland and *Salix* spp. (willow)-*Typha angustifolia* (cattail) marsh.

The preserve harbors a diversity of wildlife, including mink, Massasauga rattlesnake, and over 75 species of nesting birds.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

110. Riverbank Sanctuary

TYPE: natural area preserve

ACREAGE: 23

LOCATION: Sect. 34, T42N, R16W; Schoolcraft Co.

PROTECTION: ownership by Michigan Audubon Society

DATE OF PROTECTION: 1949

OWNERSHIP: Michigan Audubon Society

ADMINISTRATION: Michigan Audubon Society

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on a flat, sandy glacial lake plain and fronts on the Indian River. *Pinus resinosa* (red pine) and *Picea mariana* (black spruce) dominate over most of the acreage. However, along the river, *Thuja occidentalis* (white-cedar), *Tsuga canadensis* (hemlock), *Pinus strobus* (white pine), and *Abies balsamea* (balsam fir) prevail.

REFERENCE: Messner & Messner, 1946.

ADDRESS: Michigan Audubon Society

7000 N. Westnedge

Kalamazoo, MI 49001

111. Riverbend Natural Area

TYPE: natural area preserve/managed preserve

ACREAGE: 120

LOCATION: Sect. 31, T3N, R2W; Sect. 6, T2N, R2W; Ingham Co.

PROTECTION: resolution by Ingham County Parks Trustees

DATE OF PROTECTION: ca. 1976

OWNERSHIP: Ingham County

ADMINISTRATION: Ingham County Parks Trustees

DEVELOPMENTS: foot trail system, interpretive facility

MANAGEMENT: planting for wildlife food and cover in certain areas

GENERAL CHARACTER: This preserve borders on the Grand River where it flows through a gently rolling till plain. Nearly twenty percent of the tract's acreage consists of floodplain. A 2-acre pond occupies the site of a former gravel pit.

The preserve's upland forest is a young *Acer saccharum* (sugar maple)-*Fagus grandifolia* (beech) association in which *Quercus alba* (white oak), *Quercus rubra* (red oak), and *Prunus serotina* (black cherry) are also important. A large portion of the tract's upland supports old fields in various stages of succession.

Wildlife of the area includes mink, fox, deer, and over 120 bird species.

REFERENCE: Deming (pers. comm.).

ADDRESS: Ingham County Park Trustees

301 Bush St.

Mason, MI 48854

112. Robert Powell Memorial Nature Sanctuary (Bean Creek Nature Sanctuary)

TYPE: natural area preserve

ACREAGE: 55

LOCATION: Sect. 33, T7S, R1E; Lenawee Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1967

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The sanctuary lies on a till plain near the eastern edge of the Wabash Moraine and is bordered by Bean Creek. Much of the area consists of floodplain.

Common tree and shrub species in this lowland forest include *Asimina triloba* (pawpaw), *Aesculus glabra* (Ohio buckeye), *Zanthoxylum americanum* (prickly-ash), *Staphylea trifoliata* (bladdernut), *Populus tremuloides* (quaking aspen), and *Crataegus* spp. (hawthorn). In all, nearly 50 tree and shrub species are known from this relatively small area.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

113. Robinson Preserve

TYPE: natural area preserve

ACREAGE: 80

LOCATION: Sect. 21, T7S, R20W; Berrien Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1968, November 29

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: dirt road, abandoned residence

MANAGEMENT: none

GENERAL CHARACTER: The topography is diverse, consisting of sandy glacial lake-bed, low fossil dunes, a deeply cut stream valley and some clayey till plain. Second-growth forest and open woodland dominate the preserve' once-cultivated ground. Old apple orchards may still be found, but young forest of *Acer rubrum* (red maple), *Sassafras albidum* (sassafras), *Prunus serotina* (black cherry), and *Populus grandidentata* (big-tooth aspen) cover most of the acreage. A stream-cut ravine—the preserve's least-disturbed habitat—supports a *Fagus grandifolia* (beech)-*Acer saccharum* (sugar maple) association.

Red Fox, opossum, and raccoon inhabit the area, as do the yellow-billed cuckoo, scarlet tanager, indigo bunting, and red-tailed hawk.

REFERENCE: Lindsey & Escobar, 1976.

ADDRESS: The Nature Conservancy

531 N. Clippert

Lansing, MI 48912

114. Roscommon Red Pines Nature Study Area

TYPE: natural area preserve

ACREAGE: 160

LOCATION: Sect. 2, T24N, R1W; Roscommon Co. (Houghton Lake State Forest)

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1966, May 13

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Forestry Division

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The outstanding feature on this flat, sandy tract is a 34-acre grove of virgin *Pinus resinosa* (red pine). Numerous individuals exceed 28 inches dbh. The soil profile, thought to be largely responsible for this outstanding growth, consists of sand underlain by a thin clay layer, then a second layer of sand. Intermixed with the red pine are *Pinus strobus* (white pine), *Quercus* spp. (oak), and *Prunus serotina* (black cherry). A heavy growth of *Pinus banksiana* (jack pine) surrounds the grove and gives way to an open savannah on the preserve's southeastern corner.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Forestry Division, Stevens T. Mason Bldg.
Lansing, MI 48909



114. Roscommon Red Pines Nature Study Area

115. Sauk Indian Trail Prairie Plant Preserve

TYPE: natural area preserve

ACREAGE: 0.25

LOCATION: Sect. 7, T8S, R10W; St. Joseph Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1978, May 22

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: This preserve, which occupies a triangle of land bordered by highway and railroad, supports a very rich mesic prairie flora. Important species include *Ratibida pinnata* (yellow coneflower), *Amorpha canescens* (leadplant), *Andropogon* spp. (bluestem), and *Solidago rigida* (stiff goldenrod).

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

116. Schmude Memorial Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 55

LOCATION: Sect. 31, T4N, R9E; Oakland Co.

PROTECTION: deed restriction

DATE OF PROTECTION: 1975, February

OWNERSHIP: Independence Land Conservancy

ADMINISTRATION: Independence Land Conservancy

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The tract includes part of a lake and the adjacent lowland. Mature *Larix laricina* (tamarack) swamp forest dominates the acreage, with *Typha* sp. (cattail) and sedge-grass marsh along the lake margin.

ADDRESS: Independence Land Conservancy

72 N. Main St.

Clarkston, MI 48016

117. Schwark Road Prairie

TYPE: managed preserve

ACREAGE: 3.6

LOCATION: Sects. 3 & 4, T8S, R20W; Berrien Co.

PROTECTION: legal agreement with The Nature Conservancy

DATE OF PROTECTION: 1978, December

OWNERSHIP: AMTRAK

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: none

MANAGEMENT: periodic burning and brush removal

GENERAL CHARACTER: This railroad right-of-way strip prairie is mesic in nature, with a clay-loam soil and mollic horizon. Common plant species include *Andropogon gerardii* (big bluestem), *Lupinus perennis* (wild lupine) and *Pycnanthemum virginianum* (mountain mint).

REFERENCE: Michigan Natural Areas Council, 1978.

ADDRESS: The Nature Conservancy

531 N. Clippert

Lansing, MI 48912

118. Seney National Wildlife Refuge

TYPE: natural area preserve/managed preserve

ACREAGE: 95,455

LOCATION: T44-46N, R13-15W; Schoolcraft Co.

PROTECTION: designation as National Wildlife Refuge

DATE OF PROTECTION: 1935

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service

DEVELOPMENTS: artificial impoundments, gravel and dirt roads, foot trails, visitor center, maintenance facilities, picnic area

MANAGEMENT: The Refuge is divided into three general management units as follows:

- 1) Eastern unit (approx. 9000 acres)—intensively managed for waterfowl habitat with impoundments and other water-level manipulations; also includes three farm units.
- 2) Central unit (approx. 14,000 acres)—less intensively managed, with several impoundments and some timber management for wildlife cover; includes two farm units.
- 3) Western unit (approx. 72,000 acres)—lightly managed, with few impoundments, limited timber management and one farm unit; includes 25,000-acre Wilderness Area which is unmanaged. (see listing for Seney Wilderness)

GENERAL CHARACTER: The topography of Seney National Wildlife Refuge is a product of glacial outwash and inundation by glacial Lake Algonquin, which deposited a veneer of sand over the area. The land slopes from northwest to southeast at about 8 feet per mile. Dominant geomorphic features are fossil dunes and beach ridges; and except on these features, the water table usually lies at or above the mineral soil surface, creating vast marshes throughout the Refuge. Drainage follows the regional slope by way of several streams which join the Manistique River as it flows through the Refuge's southeast corner.

Upland plant communities are concentrated in the southeast and northwest; most prevalent are *Pinus banksiana* (jack pine), *Pinus resinosa* (red pine), and mixed conifer associations. Hardwood communities, more limited in extent, are largely *Populus* (aspen)-dominated. The Manistique Swamp covers over fifty

percent of the Refuge's total acreage. Its open marsh or muskeg is dotted with swamp forests of *Larix laricina* (tamarack) and *Picea mariana* (black spruce). (See listing for Strangmoor Research Natural Area.)

Beaver, mink, muskrat, otter, coyote, fox, bear, and bobcat are among the many mammals of the refuge. Well over 200 bird species are also known from the area.

REFERENCES: Bergquist, 1936; Heinselman, 1965; Migratory Bird & Habitat Res. Lab., 1978; U.S. Dep. Interior, 1978, 1979.

ADDRESS: Seney National Wildlife Refuge
Seney, MI 49883



119. Seney Wilderness (Seney NWF)

119. Seney Wilderness

TYPE: natural area preserve

ACREAGE: 25,150

LOCATION: T44-46N, R15W; T45N, R16W; Schoolcraft Co. (Seney National Wildlife Refuge)

PROTECTION: under Federal Wilderness Act

DATE OF PROTECTION: 1970, October 23

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Seney National Wildlife Refuge

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Vast boglands dominate the landscape of the Seney Wilderness. Fossil dunes scattered throughout the area rise above the patterned wetland vegetation or "strangmoor." (See listing for Strangmoor Research Natural Area.) Uplands along the area's northern and western portions support *Populus* (aspen) and mixed conifer forests which developed following the removal of *Pinus strobus* (white pine) and subsequent fires. A wildfire in 1976 again burned most of the area.

Several important wildlife species reported from the preserve include eastern timber wolf, bald eagle, and moose. Other, more typical, inhabitants are bear, coyote, fox, mink, muskrat, American widgeon, and spruce, ruffed, and sharp-tailed grouse. Preliminary reports indicate a positive effect of the 1976 fire on wildlife populations and diversity, with production of a habitat mosaic through irregular burning.

REFERENCES: (See references for Seney National Wildlife Refuge.)

ADDRESS: Seney National Wildlife Refuge
Seney, MI 49883

120. Seven Ponds Nature Center

TYPE: natural area preserve/managed preserve

ACREAGE: 243

LOCATION: Sects. 17 & 20, T6N, R11E; Lapeer Co.

PROTECTION: ownership by Michigan Audubon Society

DATE OF PROTECTION: 1966

OWNERSHIP: Michigan Audubon Society

ADMINISTRATION: Michigan Audubon Society

DEVELOPMENTS: interpretive building, staff homes, maintenance barn, foot trails, prairie reconstruction plot

MANAGEMENT: burning of prairie plot, planting of food species in waterfowl management area

GENERAL CHARACTER: The preserve straddles the boundary between an interlobate glacial moraine and low-lying, pitted outwash. A series of small, eutrophic lakes occur on the latter and occupy most of the preserve's western half. In the lowland around the lakes, swamp forests of *Acer rubrum* (red maple) and *Thuja occidentalis* (white-cedar) merge with lake-edge thickets of *Cornus* sp. (dogwood), *Typha latifolia* (cattail), and *Decodon verticillatus* (swamp loosestrife). The eastern upland portion of the site supports primarily old fields, with the exception of a ten-acre prairie reconstruction.

Over 190 bird species have been sighted on the preserve. A number of small mammals are present, in addition to common and rare amphibians.

REFERENCE: Hayes (pers. comm.).

ADDRESS: Seven Ponds Nature Center
3854 Crawford Rd.
Dryden, MI 48428

121. Shadbrush Nature Study Area

TYPE: natural area preserve

ACREAGE: 70

LOCATION: Sect. 29, T3N, R12E; Macomb Co. (Rochester-Utica Recreation Area)

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1966, April 8

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: The tract lies in a broad valley of lake plain/river delta sediments cut by glacial meltwaters. The modern Clinton River now occupies the lowest part of this valley and forms the preserve's eastern boundary. The steep banks of the fossil river valley border the area on the south. A mixed hardwood forest of *Fagus grandifolia* (beech), *Acer saccharum* (sugar maple), and *Quercus* spp. (oak) on these peripheral slopes gives way to a *Larix laricina* (tamarack)-*Thuja occidentalis* (white-cedar)-*Betula alleghaniensis* (yellow birch) swamp which dominates the preserve's interior. *Typha* (cattail) marsh and wet meadows border the Clinton River.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

122. Shannon Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 20

LOCATION: Sects. 31 & 32, T4N, R6E; Livingston Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1977, June

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The preserve is geomorphically diverse and includes till plain, glacial outwash, and, most widespread, interlobate moraine. The Lake Shannon flooding serves as its western border and North Ore Creek flows through the property. Upland plant communities include hardwood forest, old field, and pine plantation. Marshy floodplains flank both Lake Shannon and North Ore Creek.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

123. Shiawassee National Wildlife Refuge

TYPE: managed preserve

ACREAGE: 8897

LOCATION: T11N, R4E; Saginaw Co.

PROTECTION: designation as National Wildlife Refuge

DATE OF PROTECTION: 1953

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service

DEVELOPMENTS: extensive dike system to control flooding, pump stations and water level control structures

MANAGEMENT: primarily for waterfowl habitat; cultivation of 1800 acres for wildlife food, maintenance of moist soil units (600 acres), pools (750 acres), and grassland (500 acres) for waterfowl nesting

GENERAL CHARACTER: The Refuge lies primarily on the Shiawassee Flats, a former plain of glacial Lake Saginaw, where the Saginaw River is joined by three of its major tributaries—the Cass, Flint, and Titabawassee Rivers. A series of Nipissing and Algoman beach ridges lies in the Refuge's northeast corner. These and the valleys of the Saginaw River and its tributaries constitute the only notable geomorphic features; the remainder of the acreage consists of flood plain and undergoes periodic inundation.

Hardwood swamp forests of *Acer saccharinum* (silver maple), *Ulmus americana* (American elm), *Acer rubrum* (red maple), and *Fraxinus americana* (white ash) cover about 35% of the Refuge. The remaining acreage is unforested except for scattered *Salix* spp. (willow) and *Populus deltoides* (cottonwood). Dominants in these marsh and moist soil units include *Typha* spp. (cattail), *Polygonum* spp. (smartweed), *Echinochloa* sp. (wild millet), *Phalaris arundinacea* (reed canary grass), *Scirpus* spp. (bulrush), and *Lythrum salicaria* (loosestrife).

The Refuge supports a diversity and abundance of wildlife. Deer, red fox, beaver, and mink are common mammals. Among the permanent and seasonal birds are great egret, bald eagle, osprey, black-crowned night heron, lapland longspur and whistling swan, to mention only a few.

REFERENCE: Environmental Assessment for the Shiawassee National Wildlife Refuge, n.d.

ADDRESS: Shiawassee National Wildlife Refuge

6975 Mower Rd. RR #1

Saginaw, MI 48601

124. Snake Island-Mud Lake Nature Study Area

TYPE: natural area preserve

ACREAGE: 244

LOCATION: Sect. 26, Bois Blanc Island; Mackinac Co. (Black Lake State Forest).

PROTECTION: under Michigan's Wilderness and Natural Areas Act

DATE OF PROTECTION: 1977, December 23

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Forestry Division

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Bois Blanc dolomite underlies this preserve, which is a lowland with numerous swamps, ponds, and hollows. Mud Lake is included, as well as frontage on both Lake Thompson and Lake Huron. The small Snake Island is usually connected to the main island by a narrow land bridge. Dominants on this forested tract are *Thuja occidentalis* (white-cedar) and *Betula papyrifera* (paper birch), variously associated with *Larix laricina* (tamarack), *Abies balsamea* (balsam fir), and *Picea glauca* (white spruce).

Evidence of extensive beaver workings exists in the area.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Forestry Division, Stevens T. Mason Bldg.
Lansing, MI 48909

125. South Campus Nature Preserve

TYPE: natural area preserve

ACREAGE: 10

LOCATION: T1N, R12E; Macomb Co. (City of Warren).

PROTECTION: resolution by College Trustees

DATE OF PROTECTION: 1977, December

OWNERSHIP: Macomb County Community College

ADMINISTRATION: South Campus Biology Department

DEVELOPMENTS: foot trails, artificial lake

MANAGEMENT: none

GENERAL CHARACTER: The preserve is located on a plain of glacial lake clays. A pond which was filled by the College prior to dedication has been replaced by a recently excavated half-acre lake, in the hope of attracting migratory waterfowl. The site is forested with a *Fagus grandifolia* (beech)-*Acer saccharum* (sugar maple) association which includes *Juglans nigra* (black walnut), *Juglans cinerea* (butternut), and *Carya ovata* (shagbark hickory).

Squirrel, raccoon, horned owl, and finches are among the wildlife reported from the area.

REFERENCE: Arnfield (pers. comm.).

ADDRESS: Biology Department
Macomb County Community College, South Campus
14500 12 Mile Rd.
Warren, MI 48093

126. South Island

TYPE: natural area preserve

ACREAGE: 13

LOCATION: Sect. 27, T27N, R12W; Grand Traverse Co.

PROTECTION: ownership by Long Lake Preservation Association

DATE OF PROTECTION: 1978, September 1

OWNERSHIP: Long Lake Preservation Association

ADMINISTRATION: Long Lake Preservation Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: South Island is one of several islands in Long Lake, which lies in an area of glacial outwash southwest of Traverse City. The island supports a forest which includes *Tsuga canadensis* (hemlock), *Fagus grandifolia* (beech), *Acer rubrum* (red maple), and *Pinus strobus* (white pine).

REFERENCE: Strong (pers. comm.).

ADDRESS: Long Lake Preservation Association

131 E. State St.

Traverse City, MI 49684



128. Strangmoor Bog Research Natural Area (Seney NWF)

127. St. Clair-Former Schenck Woods Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 124

LOCATION: Sects. 16 & 17, T6N, R16E, St. Clair Co.

PROTECTION: ownership by Michigan Nature Association; resolution by Detroit Audubon Society

DATE OF PROTECTION: 1977, May

OWNERSHIP: Michigan Nature Association (49 acres); Detroit Audubon Society (75 acres)

ADMINISTRATION: Michigan Nature Association; Detroit Audubon Society

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Glaciolacustrine sediments slope gently to the south in this low-lying tract, near which the Pine River flows. It supports a rich, moist woods of *Fagus grandifolia* (beech), *Tsuga canadensis* (hemlock), and *Betula alleghaniensis* (yellow birch) with a dense spring flora.

REFERENCE: Daubendiek (pers. comm.).

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

128. Strangmoor Bog Research Natural Area

TYPE: natural area preserve

ACREAGE: 640

LOCATION: Sect. 33, T45N, R15W, Schoolcraft Co. (Seney National Wildlife Refuge).

PROTECTION: designation as Research Natural Area by U.S. Fish & Wildlife Service

DATE OF PROTECTION: 1966

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Seney National Wildlife Refuge

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: Now part of the larger Strangmoor Bog National Natural Landmark (9500 acres), the preserve consists of Algonquin lake bed inclined slightly to the southeast, and strewn with fossil dunes and sandbars lying parallel to the regional drainage. Interdunal wetland vegetation is patterned into bands across that slope, producing "string bog" or strangmoor. A primarily boreal phenomenon, strangmoor reaches one of its southernmost North American occurrences here at Seney.

The fossil dunes support *Pinus resinosa* (red pine)-*Pinus strobus* (white pine) associations, which grade downslope (local and regional) into "tails" of bog forest dominated by *Larix laricina* (tamarack). In the string bogs between these scattered knolls and tails of forest are crossbands of *Betula pumila* (swamp birch), *Potentilla fruticosa* (shrubby cinquefoil), and *Salix* spp. (willow). The

intervening wetter crossbands or "flarks" are dominated by characteristic herbaceous bog species. Although this area was largely burned in the 1976 fire, leaving little living vegetation, it should be noted that fire is a normal and not uncommon component of many natural ecosystems, and may serve merely to retard succession without radically altering its course.

Animals inhabiting the area include deer, bear, fox, mink, and muskrat.

REFERENCES: Federal Committee on Ecological Reserves, 1977; Heinselman, 1965.

ADDRESS: Seney National Wildlife Refuge
Seney, MI 49883

129. Sturgeon Bay-Sucker Creek Natural Area Preserve

TYPE: natural area preserve

ACREAGE: 550

LOCATION: Sects. 28, 29, 32, & 33, T39N, R5W; Emmet Co. (Wilderness State Park).

PROTECTION: dedicated under administrative authority of Natural Resources Commission

DATE OF PROTECTION: 1951, April 19

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: dirt road

MANAGEMENT: none



129. Sturgeon Bay—Sucker Creek Natural Area Preserve

GENERAL CHARACTER: The topography of the preserve was formed by the receding shore of ancestral Lake Michigan, which left a series of parallel beach ridges with intervening swales. A strip of active dunes forms the modern shore. Big Sucker and Little Sucker Creeks flow through the tract, the latter forming its northern boundary.

The inland is forested with *Pinus* spp. (pine) on the ridges and supports marsh, shrub swamp, and bog forest in the swales. Swamp hardwoods border some sections of Big Sucker Creek, and include *Fraxinus nigra* (black ash), *Acer rubrum* (red maple), and *Ulmus americana* (elm). On the active shore dunes, scattered *Pinus strobus* (white pine) and *Thuja occidentalis* (white-cedar) back a foredune of *Ammophila breviligulata* (beach grass), *Elymus canadensis* (wild rye), and other dune species.

Wildlife reported from the Park in general include red-breasted nuthatch, magnolia warbler, tree swallow, pileated woodpecker, parula warbler, beaver, bear, and water shrew.

REFERENCES: Michigan Natural Areas Council, 1979a; Pettingill et al., 1957.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

130. Sylvania Recreation Area Botanical Zone

TYPE: natural area preserve

ACREAGE: 5072

LOCATION: T44N, R40W; Gogebic Co. (Sylvania Recreation Area).

PROTECTION: special designation by U.S. Forest Service

DATE OF PROTECTION: 1968, December 5

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Forest Service

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: Sylvania lies on a broad glacial moraine deposited by the Lake Superior ice lobe. The hummocky nature of the moraine contributes to a gently rolling topography with numerous lakes. The knolls and slopes are heavily wooded, many with largely unlogged climax forests of *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), *Tilia americana* (basswood), and *Tsuga canadensis* (hemlock), with intermixed *Pinus strobus* (white pine). Drier uplands are often dominated by *Pinus resinosa* (red pine) and *Pinus strobus* (white pine). Several unusually fine sphagnum bogs are in the Botanical Zone, with floating mats and the usual assemblages of characteristic species. There is also a springy conifer swamp with much *Thuja occidentalis* (white-cedar). In addition to the usual hemlock-hardwoods on uplands, the Botanical Zone includes a stand of old-growth sugar maple.

REFERENCE: Voss (pers. comm.).

ADDRESS: District Forest Ranger
Ottawa National Forest
Watersmeet, MI 49969

131. Tahquamenon Falls State Park Natural Area

TYPE: natural area preserve

ACREAGE: 2265

LOCATION: T49N, R7W, Chippewa Co.; T49N, R8W; Luce Co. (Tahquamenon Falls State Park).

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1954, August 13

OWNERSHIP: State of Michigan

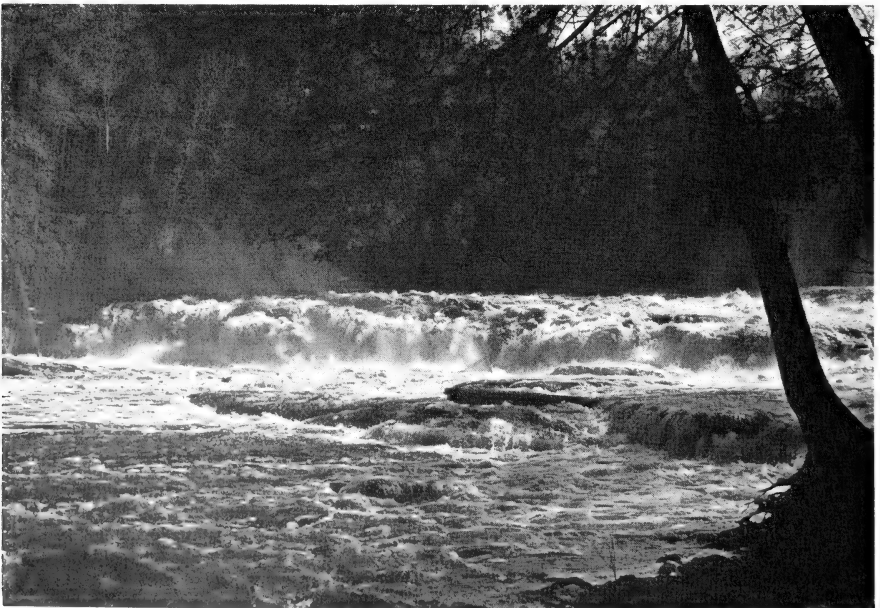
ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: The Tahquamenon River emerges from its swampy course north of the Newberry Moraine to flow over a ledge of Cambrian sandstone at the Upper Falls, then through a gorge of the same material to the Lower Falls. The bedrock on both sides of the river is veneered with drift of the Munising Morainal complex, rising to elevations of 800 feet. The moraine is characterized by a rolling topography of knolls and basins, the latter sometimes occupied by lakes or swamps. Near the river, the uplands are dissected with deep ravines cut by tributary streams. The entire moraine in this region was inundated by the waters of glacial Lake Algonquin.

The morainal uplands support mature northern hardwood forests dominated by *Fagus grandifolia* (beech) and *Acer saccharum* (sugar maple). Variations include co-dominance of *Betula alleghaniensis* (yellow birch) and *Tsuga canadensis* (hemlock), an abundance of *Pinus strobus* (white pine), and almost pure stands of *Tsuga canadensis* (hemlock). A spectrum of mesic and bog forests occupy poorly-drained depressions. These range from *Betula alle-*



131. Tahquamenon Falls State Park Natural Area (J. Roethle, DNR)

ghaniensis (yellow birch)-*Tsuga canadensis* (hemlock)-*Acer rubrum* (red maple) associations to *Picea* sp. (spruce)-*Thuja occidentalis* (white-cedar) swamps.

REFERENCES: Bergquist, 1931; Braun, 1950; Leverett, 1929; Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

132. Thompson Road Prairie

TYPE: managed preserve

ACREAGE: 1.1

LOCATION: Sect. 5, T7S, R16W; Sect. 32, T6S, R16W; Cass Co.

PROTECTION: legal agreement with The Nature Conservancy

DATE OF PROTECTION: 1978, December

OWNERSHIP: AMTRAK

ADMINISTRATION: The Nature Conservancy

DEVELOPMENTS: none

MANAGEMENT: periodic burning and brush removal

GENERAL CHARACTER: This mesic strip prairie is rich in species diversity.

Among the many common species are *Andropogon gerardii* (big bluestem), *Ratibida pinnata* (yellow coneflower), *Silphium terebinthinaceum* (prairie-dock), *Sorghastrum nutans* (Indian grass), and *Solidago rigida* (stiff goldenrod).

REFERENCE: Michigan Natural Areas Council, 1978.

ADDRESS: The Nature Conservancy
531 N. Clippert
Lansing, MI 48912

133. Thompson's Harbor Natural Area

TYPE: natural area preserve

ACREAGE: 260

LOCATION: Sects. 11 & 14, T34N, R7E; Presque Isle Co. (Alpena State Forest).

PROTECTION: under Michigan's Wilderness and Natural Areas Act

DATE OF PROTECTION: 1979, February 6

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Forestry Division

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The underlying Dundee Formation is evidenced only by a narrow limestone shore, with the remainder of the tract veneered by dune sand. The latter lends a rolling dune and swale topography, especially near the shore.

The high, narrow foredune possesses a typical sand flora, and is backed by a forest of *Thuja occidentalis* (white-cedar), *Pinus resinosa* (red pine), and *Picea glauca* (white spruce). Farther inland, *Betula papyrifera* (paper birch) and *Populus* spp. (aspen) become dominant.

ADDRESS: Michigan Dept. of Natural Resources
Forestry Division, Stevens T. Mason Bldg.
Lansing, MI 48909

134. Timberland Swamp Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 245

LOCATION: Sects. 27 & 34, T4N, R8E; Oakland Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1967

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: Situated on an outwash plain sloping to the south, Timberland Swamp is a relatively flat, low-lying tract which undergoes extensive spring flooding from numerous springs and small streams.

Nearly the entire preserve is wooded with a patchwork of hardwood swamp and *Fagus grandifolia* (beech)-*Acer saccharum* (sugar maple) forest, mostly secondary, but with a scattering of large virgin trees. The swamp forest is dominated by *Fraxinus* spp. (ash), *Tilia americana* (basswood), *Betula alleghaniensis* (yellow birch), and *Acer* spp. (maple). A marsh including *Typha latifolia* (cattail), *Solidago* spp. (goldenrod), and *Eupatorium* spp. (joe-pye-weed) occupies the preserve's northeastern corner.

Wildlife of the area includes opossum, fox, mink, ruffed grouse, great horned owl, and hairy and red-bellied woodpeckers.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

135. Tobico Marsh

TYPE: managed preserve

ACREAGE: 1652

LOCATION: Sects. 13, 14, 23-25, T15N, R4E; Sects. 19 & 30, T15N, R5E; Bay Co. (Tobico Marsh State Game Area).

PROTECTION: dedicated under administrative authority of Natural Resources Commission

DATE OF PROTECTION: 1966, December 19

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Wildlife Division

DEVELOPMENTS: dike and weir at south end

MANAGEMENT: water level control

GENERAL CHARACTER: Tobico Marsh is bounded on the west by Nipissing beach ridges and on the east by modern beach ridges. About one-quarter of the preserve is inundated or marshy.

The vascular flora of the open lagoon is typified by species of *Ceratophyllum* (hornwort), *Myriophyllum* (water-milfoil), *Potamogeton* (pondweed), and *Lemna* (duckweed). Masses of *Typha angustifolia* (cattail) from the surrounding marsh often detach to become free-floating mats. Other marsh components include *Scirpus* spp. (bulrush), *Salix* spp. (willow), *Pontederia cordata* (pick-

erelweed), *Carex* spp. (sedge), and *Onoclea sensibilis* (sensitive fern). The fossil beach ridges to the west are forested with *Pinus strobus* (white pine), *Quercus* spp. (oak), *Acer* spp. (maple), *Populus* sp. (aspen), and *Betula papyrifera* (paper birch). Intervening wetpannes support swamp forests of *Fraxinus nigra* (black ash), *Acer rubrum* (red maple), and *Nyssa sylvatica* (pepperidge).

Common wildlife in the lagoon and marsh include terns, great blue heron, least bittern, belted kingfisher, ruddy duck, muskrat, numerous turtle species, and leopard frog.

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Wildlife Division, Stevens T. Mason Bldg.
Lansing, MI 48909

136. Toumey Woodlot

TYPE: natural area preserve

ACREAGE: 14

LOCATION: Sect. 30, T4N, R1W; Ingham Co.

PROTECTION: resolution by Department of Forestry, Michigan State University

DATE OF PROTECTION: 1939

OWNERSHIP: Michigan State University

ADMINISTRATION: Department of Forestry

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: This preserve, which lies on glacial till, supports an essentially virgin *Fagus grandifolia* (beech)-*Acer saccharum* (sugar maple) forest. Numerous individuals exceed 2 feet dbh. and are from 200 to 300 years old. Associated species include *Ulmus* spp. (elm), *Tilia americana* (basswood), *Quercus rubra* (red oak), and *Prunus serotina* (black cherry).

REFERENCE: Schneider, 1966.

ADDRESS: Department of Forestry
Michigan State University
East Lansing, MI 48824

137. Trillium Trail Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 20

LOCATION: Sect. 35, T6N, R14E; St. Clair Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1963

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: Situated on a narrow strip of waterlaid moraine in southern St. Clair County, the tract is primarily upland. Deciduous forest and old fields share this upland, while a *Larix laricina* (tamarack) fen occupies the extreme southeastern corner.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

138. Two Wilderness Islands Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 15

LOCATION: Delta Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1979, January 10

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none



138. Two Wilderness Islands Nature Sanctuary (R. Polovich, MNA)

GENERAL CHARACTER: These adjacent islands in Lake Michigan are outcroppings of the dolomitic Niagaran Cuesta. The smaller of the two islands is sparsely vegetated but supports large colonies of Caspian tern and herring gull, in addition to some double-crested cormorants. On the larger island, a forest of *Thuja occidentalis* (white-cedar), *Betula papyrifera* (paper birch), and *Ulmus americana* (elm) supports a colony of black-crowned night herons, while many herring gulls nest on the beaches.

REFERENCE: Michigan Nature Association, 1979d.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

139. Union Springs Scenic Site

TYPE: natural area preserve

ACREAGE: 160

LOCATION: Sect. 20, T51N, R42W; Ontonagon Co. (Porcupine Mountains Wilderness State Park).

PROTECTION: under Michigan's Wilderness and Natural Areas Act

DATE OF PROTECTION: 1976, May 10

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: The primary feature of this preserve is Union Spring, the second largest natural spring in the state. The site occupies a relatively low area in the Porcupines and *Thuja occidentalis* (white-cedar) swamp surrounds the spring and its resultant stream. In the adjacent uplands, *Populus* spp. (aspen) dominate a young successional forest. Beaver workings are evident along the stream.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

140. Upson Lake Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 88

LOCATION: Sect. 36, T59N, R30W; Keweenaw Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1977, January 13

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: This tract lies in the valley of weathered volcanic rock between the Outer and Great Conglomerates, with Upson Lake occupying the lowest portion of that valley. An emergent aquatic community of *Nuphar variegatum* (bullhead-lily), *Nymphaea odorata* (fragrant water-lily), *Lysimachia terrestris* (swamp loosestrife), *Myrica gale* (sweet gale), and *Chamaedaphne calyculata* (leatherleaf) skirts the lake's western margin. Backing this water's edge community is an *Abies balsamea* (balsam fir)-*Picea glauca* (white spruce)-*Larix laricina* (tamarack swamp which gives way to *Pinus resinosa* (red pine) on the adjoining upland.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043

141. Vermilion Point

TYPE: natural area preserve

ACREAGE: 9.7

LOCATION: Sect. 2, T50N, R7W; Chippewa Co.

PROTECTION: deed restriction

DATE OF PROTECTION: 1976, December 21

OWNERSHIP: Lake Superior State College

ADMINISTRATION: Lake Superior State College

DEVELOPMENTS: abandoned Coast Guard Rescue Station

MANAGEMENT: none

GENERAL CHARACTER: The property fronts on Lake Superior with a broad sandy beach. Inland, fossil beach ridges and intervening swales create a linearly patterned topography. The former support pine and mixed hardwood forests, while the swales are dominated by bog species, including *Carex* spp. (sedge), *Eriophorum* spp. (cotton-grass), and *Vaccinium* spp. (cranberry).

REFERENCE: Dodge, 1921.

ADDRESS: Lake Superior State College
Sault St. Marie, MI 49783

142. Vorhees Brothers Wildlife Sanctuary

TYPE: natural area preserve

ACREAGE: 40

LOCATION: Sect. 35, T1S, R5W; Calhoun Co.

PROTECTION: ownership by Michigan Audubon Society

DATE OF PROTECTION: 1948

OWNERSHIP: Michigan Audubon Society

ADMINISTRATION: Michigan Audubon Society

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve borders a moraine of the Charlotte complex and has a sloping upland topography with several deeply cut ravines. A mature, possibly virgin, forest dominated by *Acer saccharum* (sugar maple), *Quercus* spp. (oak), and *Prunus serotina* (black cherry) covers the site, and includes some unusually large individual trees. Other tree species present include *Fagus grandifolia* (beech), *Carya* spp. (hickory), *Tilia americana* (basswood), and *Liriodendron tulipifera* (tuliptree).

REFERENCE: Reed (pers. comm.).

ADDRESS: Michigan Audubon Society
7000 N. Westnedge
Kalamazoo, MI 49001

143. Wagner Falls Scenic Site

TYPE: natural area preserve

ACREAGE: 23

LOCATION: Sect. 14, T46N, R19W; Alger Co.

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1956, November 9

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: Wagner Creek has cut deeply through the drift of the Munising Moraine to flow over a siliceous dolomite underlain by a weak Cambrian sandstone. The stream traverses these formations in a series of low falls, with a total drop of about 150 feet. A climax northern hardwood forest occupies part of the drift-covered upland, in company with some young hardwood stands. Important species in these associations include *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), and *Tsuga canadensis* (hemlock).

REFERENCE: Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

144. Warren Dunes Nature Study Area

TYPE: natural area preserve

ACREAGE: 488

LOCATION: Sects. 25 & 26, T6S, R20W; Berrien Co. (Warren Dunes State Park).

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1966, April 8

OWNERSHIP: Warren Foundation (leased by State of Michigan)

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: The Warren Dunes include both active, modern dunes and a complex of stabilized fossil dunes of Algonquin, Nipissing, and Algoman age. Several blowouts, the largest of which is the Great Warren Dune, invade the forested hills.

A typical sand flora occupies the active dunes along Lake Michigan. In the dune forests, *Quercus rubra* (red oak), *Quercus alba* (white oak), *Tilia americana* (basswood), and *Prunus serotina* (black cherry) dominate the ridges, while *Acer saccharum* (sugar maple), *Fagus grandifolia* (beech), and *Tsuga canadensis* (hemlock) prevail in the adjacent deep valleys.

REFERENCES: Michigan Natural Areas Council, 1979a; Tague, 1977.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909



144. Warren Dunes Nature Study Area (E. Brueggemann)

145. Warren Woods Nature Study Area

TYPE: natural area preserve

ACREAGE: 179

LOCATION: Sect. 27, T7S, R20W; Berrien Co. (Warren Dunes State Park).

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1966, April 8

OWNERSHIP: Warren Foundation (leased by State of Michigan)

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trails

MANAGEMENT: none

GENERAL CHARACTER: Warren Woods lies on a gently rolling till plain into which the Galien River has cut deeply to create a diverse topography. A narrow floodplain borders the river and extends into some of the associated ravines.

The upland supports a fine example of essentially virgin beech-maple climax forest. Intermixed with the dominants—*Fagus grandifolia* (beech) and *Acer saccharum* (sugar maple)—are *Ulmus americana* (elm), *Quercus rubra* (red oak), and *Prunus serotina* (black cherry). The lowland and floodplain associations are more diverse, and include *Acer rubrum* (red maple), *Tilia americana* (basswood), *Platanus occidentalis* (sycamore), and *Fraxinus americana* (white ash), as well as the upland forest dominants.



145. Warren Woods Nature Study Area (E. Brueggmann)

Small mammals typical of the region, such as raccoon, muskrat, skunk, and opossum, are common in the woods. Resident birds include woodpecker, sapsucker, creeper, nuthatch, and pewee.

REFERENCES: Billington, 1925; Cain, 1935; Michigan Natural Areas Council, 1979a.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

146. Waterloo Black Spruce Bog Nature Study Area

TYPE: natural area preserve

ACREAGE: 40

LOCATION: Sect. 16, T1S, R2E; Jackson Co. (Waterloo Recreation Area).

PROTECTION: under Michigan's Wilderness and Natural Areas Act (originally by resolution of Natural Resources Commission)

DATE OF PROTECTION: 1967, July 14

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: none

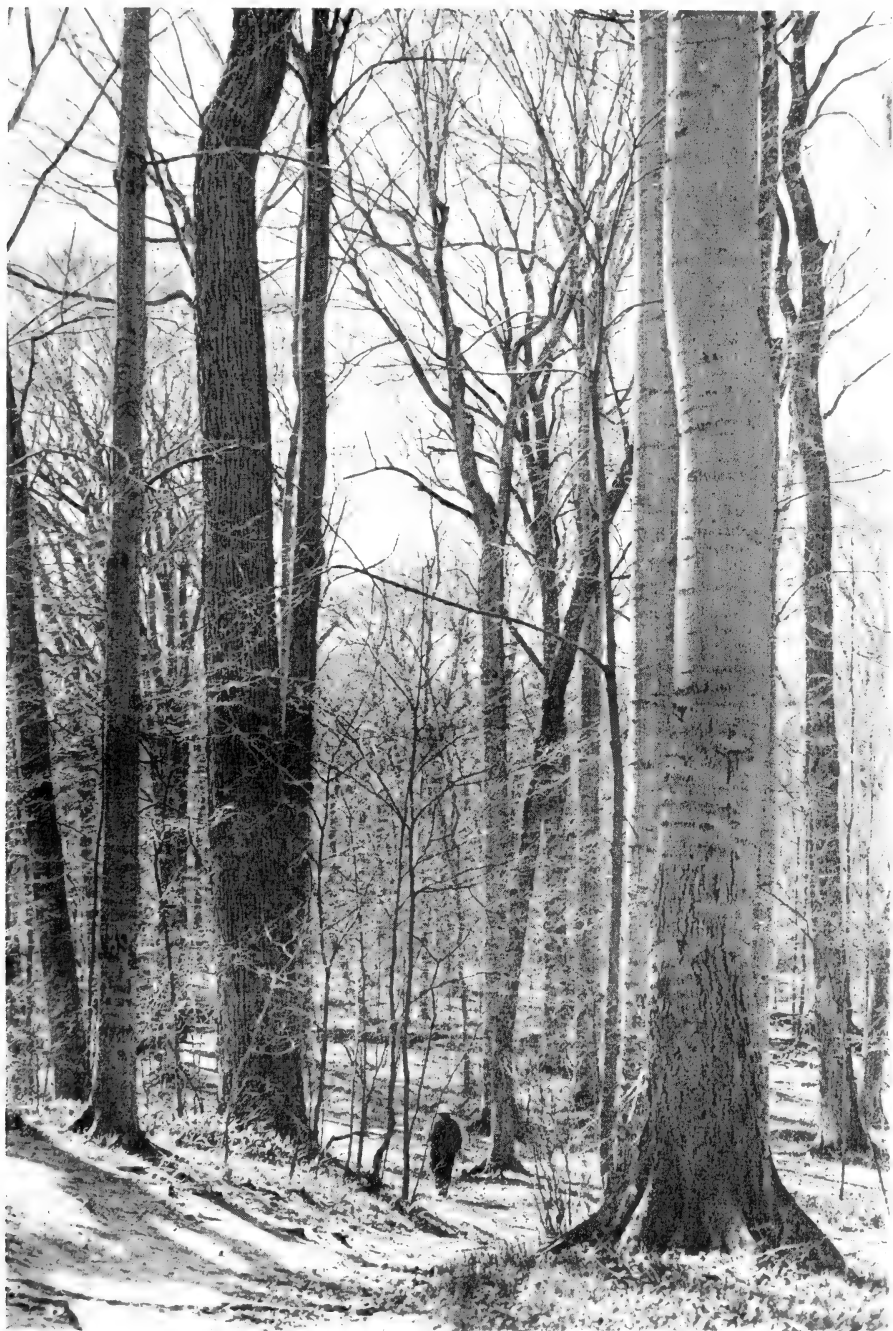
MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on a glacial outwash plain and includes the southern portion of a large ice-block depression which has been completely filled through bog succession.

Acer rubrum (red maple) and *Quercus rubra* (red oak) dominate the moist upland surrounding the bog proper, which supports one of the southernmost known occurrences of *Picea mariana* (black spruce) swamp forest. *Larix laricina* (tamarack) is also important here as are *Vaccinium corymbosum* (blueberry), *Toxicodendron vernix* (poison sumac), *Chamaedaphne calyculata* (leatherleaf), and *Aronia prunifolia* (chokeberry), which form an almost impenetrable understory.

REFERENCES: Michigan Natural Areas Council, 1979a; Ulrich, 1979.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909



145. Warren Woods Nature Study Area (C. Alway)

147. Waugoshance Point Nature Study Preserve

TYPE: natural area preserve

ACREAGE: 250

LOCATION: Sects. 23 & 24, T39N, R6W; Emmet Co. (Wilderness State Park).

PROTECTION: dedicated under administrative authority of Natural Resources Commission

DATE OF PROTECTION: 1951, April 19

OWNERSHIP: State of Michigan

ADMINISTRATION: Michigan DNR, Parks Division

DEVELOPMENTS: foot trails, cabin

MANAGEMENT: none

GENERAL CHARACTER: Waugoshance point, perched upon a mound of glacial drift, is characterized on the south by scarcely emergent gravel shores, and on the north by low dunes and sandy beaches with constantly evolving offshore bars and dune pools.

The wet gravel shores support *Lobelia kalmii* (Kalm's lobelia), *Selaginella* spp., *Castilleja coccinea* (Indian paintbrush), *Primula mistassinica* (bird's-eye primrose), and *Parnassia glauca* (grass-of-Parnassus). On the sandy beaches, a typical dune flora occupies the upland and in the beach pools, *Triglochin maritimum* (arrow-grass) and *Cladium mariscoides* (twig-rush) are common. The upland interior is forested with mixed hardwoods and conifers, while *Thuja occidentalis* (white-cedar) and *Picea glauca* (white spruce) dominate low areas.

Birds are particularly abundant on the Point; piping plover, American bittern, nighthawk, bald eagle, common tern, and spotted sandpiper are reported to nest here. Mammals reported from the Park in general include small red and northern flying squirrels, beaver, and water shrew.

REFERENCES: Michigan Natural Areas Council, 1979a; Pettingill, 1957; Schnell, 1967.

ADDRESS: Michigan Dept. of Natural Resources
Parks Division, Stevens T. Mason Bldg.
Lansing, MI 48909

148. West Wequetonsing Nature Preserve

TYPE: natural area preserve

ACREAGE: 15

LOCATION: Sect. 18, T35N, R5W; Emmet Co.

PROTECTION: ownership by The Nature Conservancy

DATE OF PROTECTION: 1973, December 14

OWNERSHIP: The Nature Conservancy

ADMINISTRATION: Little Traverse Conservancy (lessee)

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on glacio-lacustrine sediments at the base of a steeply wave-cut Nipissing bluff. Drainage is trapped below the surficial sandy soil by a bed of clay to produce moisture conditions which support a hardwood-conifer swamp. Important species in this stand, thought to be largely virgin, include *Tsuga canadensis* (hemlock), *Betula alleghaniensis* (yellow birch), and *Thuja occidentalis* (white-cedar). Several small areas of *Typha angustifolia* (cattail) also exist within the preserve.

Wildlife of the preserve includes flying squirrel and pileated woodpecker.

REFERENCE: Stanley, 1978.

ADDRESS: Little Traverse Conservancy, Inc.
Room 159, Administration Bldg.
North Central Michigan College
1515 Howard St.
Petoskey, MI 49770

149. White Pigeon River Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 58

LOCATION: Sects. 10, 15 & 16, T8S, R12W; St. Joseph Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1974, August

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: foot trail

MANAGEMENT: none

GENERAL CHARACTER: The preserve lies on the flood plain of the White Pigeon River where it traverses glacial outwash in the southwestern corner of St. Joseph County. The river winds in an ever-evolving course, creating lagoons, abandoned channels and numerous "islands" within the Sanctuary.

The tract is wooded on the upland with a *Quercus* (oak)-*Carya* (hickory) association and on the lowland flood plain with a diverse swamp forest that includes *Platanus occidentalis* (sycamore), *Fraxinus* spp. (ash), *Quercus bicolor* (swamp white oak), and *Ulmus rubra* (slippery elm), among many other species. Immediately bordering the river are *Salix* spp. (willow), *Cephalanthus occidentalis* (buttonbush), and *Saururus cernuus* (lizard's tail). The property's southern extension supports an old-field community.

Over 55 bird species are reported to nest within the preserve. These include great blue heron, green heron, prothonotary warbler, acadian flycatcher, indigo bunting and cerulean warbler. Fox squirrel, woodchuck, opossum, skunk, and muskrat are mammals common to the preserve.

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043



149. White Pigeon River Nature Sanctuary (R. Holzman, MNA)

150. White Pine Public Use Natural Area

TYPE: natural area preserve

ACREAGE: 30

LOCATION: Sect. 33, T45N, R13W; Schoolcraft Co.

PROTECTION: designation as Public Use Natural Area by U.S. Fish & Wildlife Service

DATE OF PROTECTION: 1977, March 16

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Seney National Wildlife Refuge

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: This sandy, upland site supports an old-growth *Pinus strobus* (white pine) forest, which typifies the pre-logging vegetation of the region. A small stream flows through the site.

ADDRESS: Seney National Wildlife Refuge
Seney, MI 49883

151. William P. Holliday Forest and Wildlife Preserve

TYPE: natural area preserve/managed preserve

ACREAGE: 500

LOCATION: Sects. 1 & 12, T2S, R8E; Sect. 33, T1S, R9E; Sects. 4-8, T2S, R9E; Wayne Co.

PROTECTION: deed restriction

DATE OF PROTECTION: 1958

OWNERSHIP: Wayne County

ADMINISTRATION: Wayne County Road Commission

DEVELOPMENTS: foot trail system, shelters at selected sites

MANAGEMENT: periodic burning of limited prairie areas

GENERAL CHARACTER: The preserve lies on a sandy former glacial lakebed, and is bisected by Tonquish Creek which flows toward the east. Mesic and swamp hardwood forests in various stages of succession dominate the preserve. *Quercus alba* (white oak), *Fraxinus americana* (white ash), *Acer* spp. (maple), *Fagus grandifolia* (beech), *Carya* spp. (hickory), and *Tilia americana* (basswood) are fairly common throughout. In the wettest floodplain areas, *Cornus* spp. (dogwood), *Carpinus caroliniana* (hornbeam), and *Crataegus* sp. (hawthorn) form dense shrub swamps.

ADDRESS: Wayne County Road Commission

726 City-County Bldg.

Detroit, MI 48226

152. Willow Creek Rock Ledge Nature Sanctuary

TYPE: natural area preserve

ACREAGE: 40

LOCATION: Sect. 26, T49N, R27W; Marquette Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1978, January 25

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The preserve property consists of a long, narrow strip of land which follows a 100-foot cliff. Above the ledge, a second-growth hardwood forest dominates, while below the ledge, a more mature *Tsuga canadensis* (hemlock)-northern hardwood association gives way to *Thuja occidentalis* (white-cedar) swamp bordering Willow Creek.

REFERENCE: Holzman (pers. comm.).

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

153. Woldumar Nature Study Area

TYPE: natural area preserve

ACREAGE: 188

LOCATION: Sect. 35, T4N, R3W, Eaton Co. (Woldumar Nature Center).

PROTECTION: resolution by Nature Way Association

DATE OF PROTECTION: 1967

OWNERSHIP: Nature Way Association

ADMINISTRATION: Nature Way Association

DEVELOPMENTS: foot trail system, observation dock in pond, interpretive building

MANAGEMENT: none

GENERAL CHARACTER: Relief is gentle in this preserve, which lies along the Grand River. Most notable topographically are two ravines cut by tributary streams and an artificial lagoon which adjoins the river near the property's center.

Upland forest communities include two *Fagus grandifolia* (beech)-*Acer saccharum* (sugar maple) stands, and a *Pinus strobus* (white pine)-*Picea glauca* (white spruce) plantation. Lowlands are largely shrub-dominated with *Cornus stolonifera* (red-osier dogwood), *Salix interior* (sandbar willow), and *Cephalanthus occidentalis* (buttonbush).

REFERENCE: Michigan Natural Areas Council, 1979.

ADDRESS: Nature Way Association

5539 Lansing Rd.

Lansing, MI 48917

154. Woodruff Creek-Hudspeth Memorial Plant Preserve

TYPE: natural area preserve

ACREAGE: 15

LOCATION: Sect. 34, T2N, R6E; Livingston Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1978, December 20

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: short foot trail

MANAGEMENT: none

GENERAL CHARACTER: A bowl-like depression forms the topography of this preserve, and Woodruff Creek flows through its lowland portion. A forest of *Quercus alba* (white oak) and *Carya glabra* (pignut hickory) occupies the rim of the bowl, while its slopes support shrub carr in which *Betula pumila* (dwarf birch) and *Populus tremuloides* (quaking aspen) dominate. On the bottom of the bowl lies a well-developed fen community with considerable species diversity. Among the common components are *Valeriana uliginosa* (swamp valerian), *Carex stricta* (sedge), *Sarracenia purpurea* (pitcher plant), *Silphium terebinthinaceum* (prairie-dock), and *Potentilla fruticosa* (shrubby cinquefoil).

REFERENCE: Kohring (pers. comm.).

ADDRESS: Michigan Nature Association

124 Miller

Mount Clemens, MI 48043

155. Wyandotte National Wildlife Refuge

TYPE: natural area preserve

ACREAGE: 278

LOCATION: T3S, R11E; Wayne Co.

PROTECTION: designation as National Wildlife Refuge

DATE OF PROTECTION: 1961

OWNERSHIP: U.S. Government

ADMINISTRATION: U.S. Fish & Wildlife Service, Shiawassee National Wildlife Refuge

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: The tract consists primarily of open water in the Detroit River (marked by buoys during duck hunting season) and includes Grassy and Mamajuda Islands. *Vallisneria americana* (wild-celery) grows in extensive beds and provides food for overwintering ducks, particularly redhead, canvasback, and scaup.

ADDRESS: Shiawassee National Wildlife Refuge
6975 Mower Rd. RR#1
Saginaw, MI 48601

156. Zeerip Drummond Island Memorial Plant Preserve

TYPE: natural area preserve

ACREAGE: 6.2

LOCATION: Sect. 25, T42N, R4E; Chippewa Co.

PROTECTION: ownership by Michigan Nature Association

DATE OF PROTECTION: 1975, December 30

OWNERSHIP: Michigan Nature Association

ADMINISTRATION: Michigan Nature Association

DEVELOPMENTS: none

MANAGEMENT: none

GENERAL CHARACTER: This Drummond Island preserve lies on the calcareous Niagaran cuesta, which is covered here by only a thin soil. The tract lies within one-half mile of the Lake Huron shore, and is densely forested by *Abies balsamea* (balsam fir), *Betula papyrifera* (paper birch), and *Acer saccharum* (sugar maple), with some *Populus* sp. (aspen) and *Thuja occidentalis* (white-cedar).

REFERENCE: Michigan Nature Association, 1977.

ADDRESS: Michigan Nature Association
124 Miller
Mount Clemens, MI 48043



10. Bernard W. Baker Sanctuary (M. Isham, Mich. Audubon Soc.)



120. Seven Ponds Nature Center (Mich. Audubon Soc.)

V. ONGOING AND PROSPECTIVE PROGRAMS

Most of Michigan's historically-active preservation organizations are continuing or increasing their efforts as awareness of development pressures on valuable natural areas increases. However, the 1980's should see greater teamwork among preservationists, particularly between The Nature Conservancy and Michigan's Department of Natural Resources, as a statewide natural features inventory gets underway.

Michigan Natural Features Inventory

The Nature Conservancy has contracted with the DNR to develop a Natural Features Inventory (Natural Heritage Program) in Michigan. The Conservancy has successfully established similar programs in other states. The primary goal of this program is to develop a comprehensive, centralized, and continuously updated data base on the occurrence and status of significant natural features in the state. This information will provide an objective scale for setting land protection priorities and will assist public and private planners in land use decisions.

The first step in this process will be to identify, locate, and evaluate important natural features—plant and animal species, ecosystems, and geologic features—throughout the state. This systematic approach should eliminate many of the deficiencies in Michigan's present system of nature preserves, including, for example, the under-representation of geomorphic features. Historically, landforms and geological formations—except for unusually scenic features such as waterfalls, dunes, and rocky shorelines—have been protected only through incidental inclusion in biotic preserves. The Natural Heritage approach recognizes that the evaluation and preservation of geomorphic features is essential in any attempt to preserve the full natural diversity of the state. Indeed, geomorphic features, frequently as endangered as biotic features by rampant development, often require even more vigorous effort to preserve because of their large size and prime potential for mineral extraction and residential and recreational development.

The Heritage Program methodology should also uncover many choice biotic natural areas based on the rare plants and animals and ecosystem types that they contain. Most important, again, is that the inventory and evaluation of these features will be done systematically throughout the state, ideally leaving few or no gaps in our cataloging and ultimate preservation of Michigan's natural diversity.

The initial inventory process is expected to require two years for development. Efforts will then be directed toward assuring preservation of significant areas.

Federal Wilderness Additions

The U.S. Forest Service's RARE II program, as described earlier under "Preservation Organizations," has resulted in the recommendation to Congress of eight areas (56,495 acres) in Michigan for Wilderness designation. These areas (listed below with their sizes and counties) will not become Federal Wilderness until Congress acts to designate them (although in the meantime they will be managed as such by the Forest Service).

U.S. Forest Service RARE II Wilderness recommendations.

Tract name	County	Acreage
Sylvania	Gogebic	17,974
Sturgeon River Gorge	Houghton/Baraga	13,208
Carp River	Mackinac	10,030
Little Silver Addition	Houghton	6,136
Horseshoe Bay	Mackinac	5,636
Nordhouse Dunes	Mason	2,919
Round Island	Mackinac	378
Government Island	Mackinac	214

Six additional tracts in the Sleeping Bear National Lakeshore will be recommended for Wilderness designation by the National Park Service. (A previous recommendation, submitted in 1975, was returned by the Office of Management and Budget pending the development of a General Management Plan for the Park.) Since the Management Plan is now in its final stages of development, the revised Wilderness recommendations should be submitted to Congress during 1980. However, these tracts cannot become Federal Wilderness until all incompatible uses have been removed; the Park Service estimates that this may require up to fifty years. Again, these tracts will be managed as Wilderness until the time that they are actually designated as such (Brown, pers. comm.).

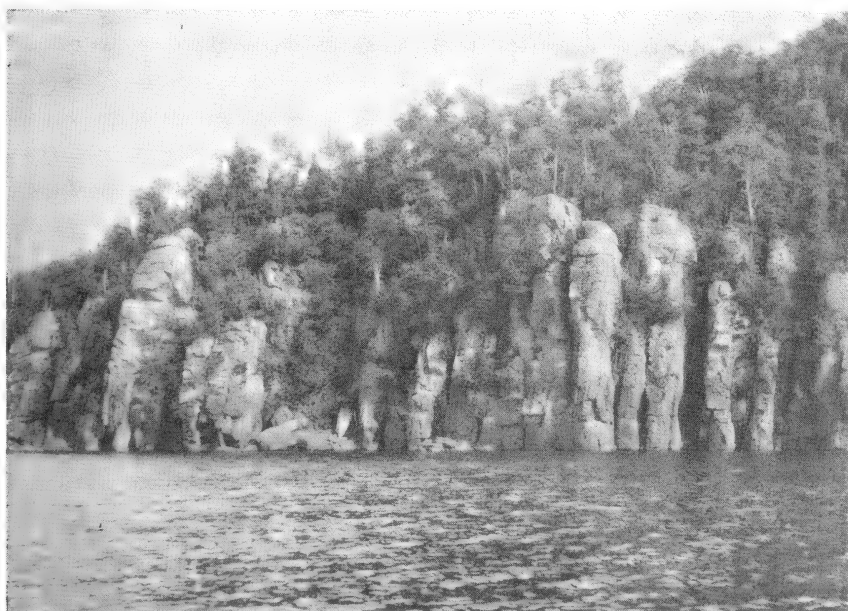
One further Wilderness evaluation will be conducted in Michigan by the Bureau of Land Management, which claims to hold some 1400 acres in the state, including 800 islands (Bureau of Land Management, 1979a). The process is scheduled to begin during the summer of 1980. An initial inventory of BLM lands in Minnesota is now in its final stages, and out of 45,344 acres under review there, approximately 160 acres of islands and 21,388 acres of mainland have been recommended for intensive review, the second stage of the inventory process. A study phase will follow, during which final decisions concerning Wilderness recommendations will be made. Those recommendations will then be sent to Congress for action (Bureau of Land Management, 1979b). This same evaluation process will be used for Michigan's BLM lands.

Miscellaneous Programs

Two other projects in the state hold some promise for natural area preservation. One is the Pictured Rocks National Lakeshore, for which a revised General Management Plan is now being developed, with consideration given to the Beaver Basin (5120 acres) for possible Wilderness recommendation. Alternately, the tract could be maintained with its present "primitive" zone designation, without formal protection or strict management requirements (Gillespie, pers. comm.).

A second natural area preservation program showing considerable promise is that of the Natural Areas Conservancy of West Michigan (NACOWMI). The organization was formed in 1976 to "inventory, acquire and steward ecologically and environmentally valuable natural areas within its designated territory for preservation and enjoyment of these areas in their natural state. . . ." (Natural Areas Conservancy of West Michigan, Inc., n.d.).

To accomplish this goal, NACOWMI is presently surveying many natural areas for potential as preserve properties, and acquisition programs have been initiated already for eight tracts. The group hopes to begin raising funds for its first purchase by 1980. The stewardship policies under which these preserves will be managed have already been outlined by NACOWMI in considerable detail, and are designed to protect and maintain the natural ecosystems with minimal human interference.



52. Isle Royale Wilderness (ca. 1905, courtesy R. Edwards)

APPENDIX A

Listing of Preserves by County

ALGER

Donahey Woods
Grand Island Research Natural Area
Laughing Whitefish Falls Scenic Site
Wagner Falls Scenic Site

ALLEGAN

Allegan State Game Area Special Habitats
Lawrence A. and Mary Bell Wade Memorial Nature Sanctuary

ALPENA

Bird Island Nature Sanctuary
Grass Island Nature Sanctuary
Gull Island Nature Sanctuary
Julius C. and Marie Moran Peter Nature Sanctuary
Michigan Islands Wilderness

ANTRIM

Cedar River Nature Sanctuary
Grass River Natural Area
Green River Nature Sanctuary
Palmer-Wilcox-Gates Preserve

BARRY

Barry State Game Area Special Habitat

BAY

Tobico Marsh

BERRIEN

Bakertown Fen
Dayton Wet Prairie
Fernwood Nature Study Area
Grand Beach Prairie
Grand Mere Nature Study Preserve
Lew Sarrett Wildlife Sanctuary
Pepperidge Dunes Plant Preserve
Robinson Preserve
Schwark Road Prairie
Warren Dunes Nature Study Area
Warren Woods Nature Study Area

BRANCH

Kope Kon Nature Sanctuary

CALHOUN

Bernard W. Baker Sanctuary
Fish Lake Bog Plant Preserve
Flowering Dogwood Plant Preserve
Harvey N. Ott Preserve
Helmer Brook Prairie Plant Preserve
Pennfield Bog Plant Preserve
Vorhees Brothers Wildlife Sanctuary

CASS

Klumbis Road Prairie
Newton Woods
Thompson Road Prairie

CHARLEVOIX

Michigan Islands Wilderness

CHIPPEWA

Betsy Lake Research Natural Area
Harbor Island
Lake Huron Sand Dunes Plant Preserve
Lake Superior Nature Sanctuary
Lapland Buttercup Plant Preserve
Tahquamenon Falls State Park Natural Area
Vermilion Point
Zeerip Drummond Island Memorial Plant Preserve

CLARE

Alta Warren Parsons Memorial Nature Sanctuary

DELTA

Two Wilderness Islands Nature Sanctuary

EATON

Woldumar Nature Study Area

EMMET

Big Stone-Cecil Bay Natural Area Preserve
Crane Island Natural Area Preserve
Sturgeon Bay-Sucker Creek Natural Area Preserve
Waugoshance Point Nature Study Preserve
West Wequetonsing Nature Preserve

GLADWIN

Briggs Memorial Nature Sanctuary

GOGEBIC

Porcupine Mountains Wilderness Area
Presque Isle River Scenic Site
Sylvania Recreation Area Botanical Zone

GRAND TRAVERSE

South Island

INGHAM

Riverbend Natural Area
Toumey Woodlot

JACKSON

Lefglen Nature Sanctuary
Phyllis Haehnle Memorial Sanctuary
Waterloo Black Spruce Bog Nature Study Area

KALAMAZOO

Flowerfield Creek Nature Sanctuary

KEWEENAW

Brockway Mountain Nature Sanctuary
Estivant Pines Nature Sanctuary
Homer L. Hylton Memorial Plant Preserve
Isle Royale Wilderness
James H. Klipfel Memorial Nature Sanctuary
Keweenaw Shore No. 1 Nature Sanctuary
Keweenaw Shore No. 2 Plant Preserve
Passage Island Research Natural Area
Upton Lake Nature Sanctuary

LAPEER

Jonathan Woods
Seven Ponds Nature Center

LENAWEE

Robert Powell Memorial Nature Sanctuary

LIVINGSTON

Shannon Nature Sanctuary
Woodruff Creek-Hudspeth Memorial Nature Sanctuary

LUCE

Betsy Lake Research Natural Area
Tahquamenon Falls State Park Natural Area

MACKINAC

Beaver Dam Nature Sanctuary
Little Brevort Lake Scenic Site
Mixed Forest Nature Study Area
Northshore Research Natural Area
Purple Coneflower Plant Preserve
Rare Fern Plant Preserve
Snake Island-Mud Lake Nature Study Area

MACOMB

Anna Wilcox Memorial Nature Sanctuary
Shadbush Nature Study Area
South Campus Nature Preserve

MANISTEE

Lucia K. Tower Preserve

MARQUETTE

Dukes Research Natural Area
Huron Islands Wilderness
Huron Mountain Club Nature Research Area
McCormick Research Natural Area

MIDLAND

Bullock Creek Nature Sanctuary

MONROE

Erie Marsh Preserve
Petersburg State Game Area Special Habitat

MONTCALM

MacCurdy Ecological Tract

MUSKEGON

Five Lakes Muskegon Plant Preserve
Hoffmaster Natural Area
Kasey Hartz Natural Area

NEWAYGO

Newaygo Prairie Ecological Study Area
Newaygo Prairie Plant Preserve

OAKLAND

Calla C. Burr Memorial Plant Preserve
Cranbrook Nature Sanctuary
Haven Hill Natural Area
Lakeville Swamp Nature Sanctuary
Proud Lake Nature Study Area
Schmude Memorial Nature Sanctuary
Timberland Swamp Nature Sanctuary

OGEMAW

Lost Lake Nature Sanctuary

ONTONAGON

Porcupine Mountains Wilderness Area
Union Springs Scenic Site

OSCEOLA

Prairie Chicken Management Area
Prairie Chicken Nature Sanctuary

OTSEGO

Hoobler Natural Area

OTTAWA

Kitchel Dunes
Hoffmaster Natural Area

PRESQUE ISLE

Besser Natural Area
Thompson's Harbor Natural Area

ROSCOMMON

Roscommon Red Pines Nature Study Area

SAGINAW

Shiawassee National Wildlife Refuge

SCHOOLCRAFT

Hemlock Research Natural Area

Huntington Memorial Plant Preserve

Northern Hardwoods Public Use Natural Area

Northern Hardwoods Research Natural Area

Red Pine Research Natural Area

Riverbank Sanctuary

Seney National Wildlife Refuge

Seney Wilderness

Strangmoor Bog Research Natural Area

White Pine Public Use Natural Area

ST. CLAIR

Algonac State Park Sites

Alton D. McGaw Memorial Plant Preserve

Big Hand Road Nature Sanctuary

Lake St. Clair National Wildlife Refuge

Mary Stallins Ray Memorial Plant Preserve

Pine River Nature Sanctuary

Port Huron State Game Area Special Habitats

Red Wing Acres Nature Sanctuary

St. Clair-Former Schenck Woods Nature Sanctuary

Trillium Trail Nature Sanctuary

ST. JOSEPH

Karl Chen Memorial Prairie Plant Preserve

Rattlesnake Master Plant Preserve

Sauk Indian Trail Prairie Plant Preserve

White Pigeon River Nature Sanctuary

VAN BUREN

Lawton Prairie

WASHTENAW

Ann Arbor Wet Prairie

Horner Woods

Mosely-Bennett-Barlow Preserve

Mud Lake Bog Research Area

Osborne Mills Riverland Preserve

WAYNE

Middle Belt Prairie

Mosely-Bennett-Barlow Preserve

William P. Holliday Forest and Wildlife Preserve

Wyandotte National Wildlife Refuge

APPENDIX B

Listing of Preserves by Ownership/Administration

U.S. Government

FISH AND WILDLIFE SERVICE

Hemlock Research Natural Area
 Huron Islands Wilderness
 Lake St. Clair National Wildlife Refuge
 Michigan Islands Wilderness
 Northern Hardwoods Public Use Natural Area
 Northern Hardwoods Research Natural Area
 Red Pine Research Natural Area
 Seney National Wildlife Refuge
 Seney Wilderness
 Shiawassee National Wildlife Refuge
 Strangmoor Bog Research Natural Area
 White Pine Public Use Natural Area
 Wyandotte National Wildlife Refuge

Total: 13 areas 109,228 acres

FOREST SERVICE

Dukes Research Natural Area
 Grand Island Research Natural Area
 McCormick Research Natural Area
 Newaygo Prairie Ecological Study Area
 Sylvania Recreation Area Botanical Zone

Total: 5 areas 9119 acres

NATIONAL PARK SERVICE

Isle Royale Wilderness
 Passage Island Research Natural Area

Total: 2 areas 131,880 acres

U.S. Government Total: 20 areas 250,227 acres

State of Michigan

FORESTRY DIVISION

Besser Natural Area
 Little Brevort Lake Scenic Site
 Mixed Forest Nature Study Area
 Northshore Research Natural Area
 Roscommon Red Pines Nature Study Area
 Snake Island-Mud Lake Nature Study Area
 Thompson's Harbor Natural Area

Total: 7 areas 3123 acres

PARKS DIVISION

Algonac State Park Sites
 Betsy Lake Research Natural Area
 Big Stone-Cecil Bay Nature Study Preserve
 Crane Island Natural Area Preserve
 Haven Hill Natural Area
 Hoffmaster Natural Area
 Laughing Whitefish Falls Scenic Site
 Porcupine Mountains Wilderness
 Presque Isle River Scenic Site
 Proud Lake Nature Study Area
 Shadbush Nature Study Area
 Sturgeon Bay-Sucker Creek Natural Area Preserve
 Tahquamenon Falls State Park Natural Area
 Union Springs Scenic Site
 Wagner Falls Scenic Site
 Warren Dunes Nature Study Area
 Warren Woods Nature Study Area
 Waterloo Black Spruce Bog Nature Study Preserve
 Waugoshance Point Nature Study Preserve

Total: 19 areas 69,827 acres

WILDLIFE DIVISION

Allegan State Game Area Special Habitats
 Barry State Game Area Special Habitat
 Petersburg State Game Area Special Habitat
 Port Huron State Game Area Special Habitats
 Prairie Chicken Management
 Tobico Marsh

Total: 6 areas 4116 acres

State of Michigan Total: 32 areas 77,066 acres

The Nature Conservancy

Bakertown Fen
 Dayton Wet Prairie
 Erie Marsh Preserve
 Grand Beach Prairie
 Harbor Island
 Hoobler Natural Area
 Jonathan Woods
 Kitchel Dunes
 Klumbis Road Prairie
 Lawton Prairie
 Lucia K. Tower Nature Preserve
 Mosely-Bennett-Barlow Preserve
 Osborne Mills Riverland Preserve
 Palmer-Wilcox-Gates Preserve
 Robinson Preserve
 Schwark Road Prairie

Thompson Road Prairie
West Wequetonsing Nature Preserve

Total: 18 areas

3793 acres

Michigan Nature Association

Alta Warren Parsons Memorial Nature Sanctuary
Alton C. McGaw Memorial Plant Preserve
Anna Wilcox Memorial Nature Sanctuary
Beaver Dam Nature Sanctuary
Big Hand Road Nature Sanctuary
Bird Island Nature Sanctuary
Briggs Memorial Nature Sanctuary
Brockway Mountain Nature Sanctuary
Bullock Creek Nature Sanctuary
Calla C. Burr Memorial Plant Preserve
Cedar River Nature Sanctuary
Estivant Pines Nature Sanctuary
Fish Lake Bog Plant Preserve
Five Lakes Muskegon Plant Preserve
Flowerfield Creek Nature Sanctuary
Flowering Dogwood Plant Preserve
Grass Island Nature Sanctuary
Green River Nature Sanctuary
Gull Island Nature Sanctuary
Helmer Brook Prairie Plant Preserve
Homer L. Hylton Memorial Plant Preserve
Huntington Memorial Plant Preserve
James H. Klipfel Memorial Nature Sanctuary
Julius C. & Marie Moran Peter Nature Sanctuary
Karl Chen Memorial Prairie Plant Preserve
Keweenaw Shore No. 1 Nature Sanctuary
Keweenaw Shore No. 2 Plant Preserve
Kope Kon Nature Sanctuary
Lake Huron Sand Dunes Plant Preserve
Lake Superior Nature Sanctuary
Lakeville Swamp Nature Sanctuary
Lapland Buttercup Plant Preserve
Lawrence A. and Mary Bell Wade Memorial Nature Sanctuary
Lefglen Nature Sanctuary
Lost Lake Nature Sanctuary
Mary Stallins Ray Memorial Plant Preserve
Newaygo Prairie Plant Preserve
Pepperidge Dunes Plant Preserve
Pennfield Bog Plant Preserve
Pine River Nature Sanctuary
Prairie Chicken Nature Sanctuary
Purple Coneflower Plant Preserve
Rare Fern Plant Preserve
Rattlesnake Master Plant Preserve
Red Wing Acres Nature Sanctuary
Robert Powell Memorial Nature Sanctuary

Sauk Indian Trail Prairie Plant Preserve		
Shannon Nature Sanctuary		
St. Clair-Former Shenck Woods Nature Sanctuary		
Timberland Swamp Nature Sanctuary		
Trillium Trail Nature Sanctuary		
Two Wilderness Islands Nature Sanctuary		
Upton Lake Nature Sanctuary		
White Pigeon River Nature Sanctuary		
Willow Creek Rock Ledge Nature Sanctuary		
Woodruff Creek-Hudspeth Memorial Nature Sanctuary		
Zeerip Drummond Island Memorial Plant Preserve		
Total:	57 areas	2909 acres

Michigan Audubon Society

Bernard W. Baker Sanctuary		
Lew Sarrett Wildlife Sanctuary		
Martha Mott Preserve		
Phyllis Haehnle Memorial Sanctuary		
Riverbank Sanctuary		
Seven Ponds Nature Center		
Vorhees Brothers Wildlife Sanctuary		
Total:	7 areas	2140 acres

Colleges and Universities

Horner Woods (Univ. of Mich.)		
Kasey Hartz Natural Area (Muskegon Comm. Coll.)		
Kitchel Dunes (Central Mich. Univ.)		
MacCurdy Ecological Tract (Alma College)		
Mud Lake Bog Research Area (Univ. of Mich.)		
Newton Woods (Mich. State Univ.)		
South Campus Nature Preserve (Macomb Comm. Coll.)		
Toumey Woodlot (Mich. State Univ.)		
Vermilion Point (Lake Superior State Coll.)		
Total:	9 areas	538 acres

Local Governments

Ann Arbor Wet Prairie (City of Ann Arbor)		
Donahey Woods (Burt Twp.)		
Grass River Natural Area (Antrim Co.)		
Harvey N. Ott Preserve (Calhoun Co.)		
Middle Belt Prairie (Huron-Clinton Metro. Auth.)		
Riverbend Natural Area (Ingham Co.)		
William P. Holliday Forest and Wildlife Preserve (Wayne Co.)		
Total:	7 areas	1753 acres

Other

(Local conservancies and private organizations)

Cranbrook Nature Sanctuary (Cranbrook Inst. Sci.)
Fernwood Nature Study Area (Fernwood, Inc.)
Grand Mere Nature Study Preserve (Kalamazoo Nature Center)
Huron Mountain Club Nature Research Area (Huron Mountain Club)
Schmude Memorial Sanctuary (Independence Land Conserv.)
South Island (Long Lake Presv. Assoc.)
St. Clair-Former Schenck Woods Nature Sanctuary (Detroit Audubon Soc.)
Woldumar Nature Study Area (Nature Way Assoc.)
Total: 8 areas 18,121 acres

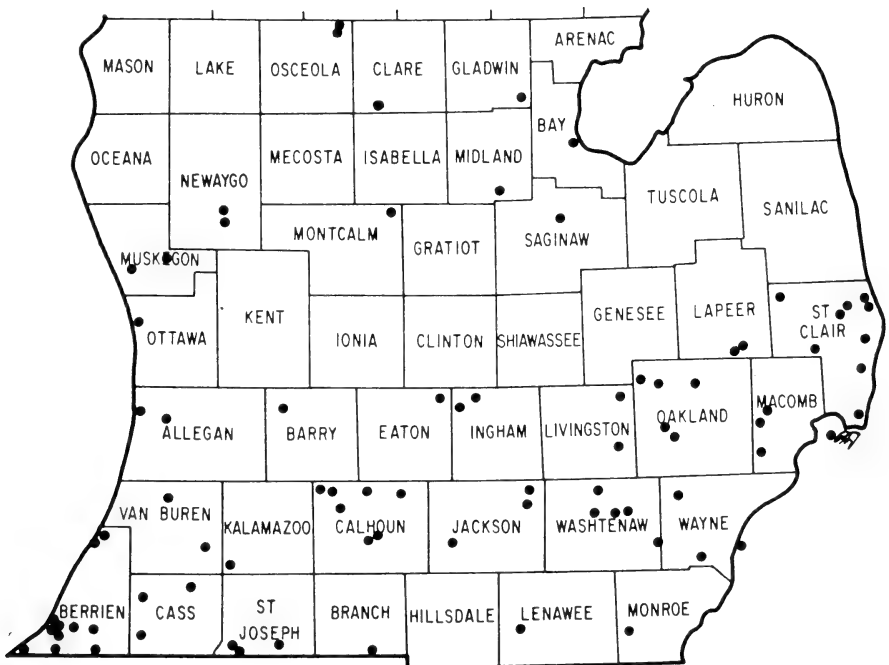
Grand Total: 156 areas 356,547 acres

(Note: This represents less than 1% of Michigan's total land acreage.)

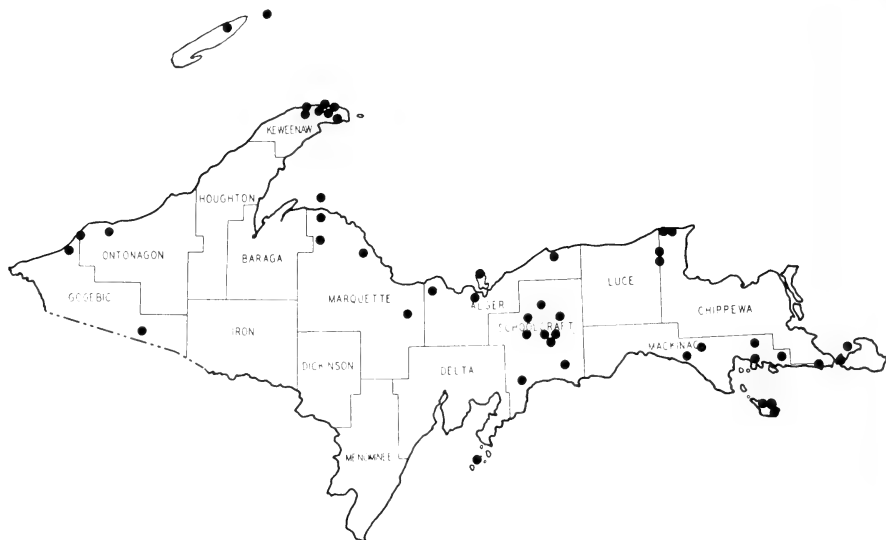
APPENDIX C

Distribution of Preserves by Region and County

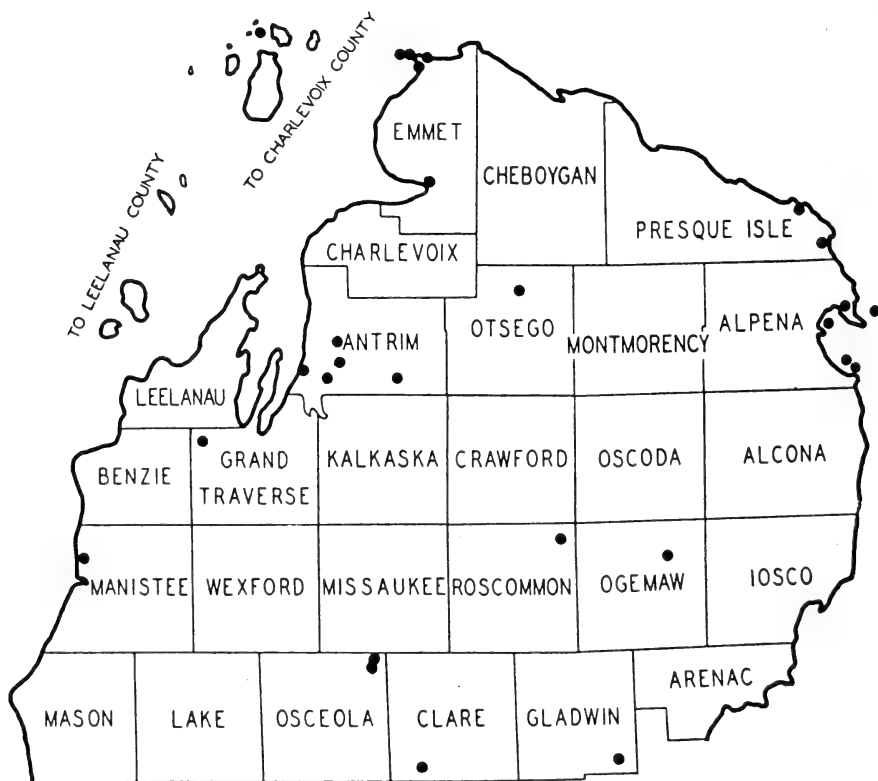
(See Appendix A for listing by county.)



Distribution of preserves in the southern Lower Peninsula of Michigan.



Distribution of preserves in the Upper Peninsula of Michigan.



Distribution of preserves in the northern Lower Peninsula of Michigan.

APPENDIX D

Listing of Preserves by Plant Community Types

Note: Communities are divided into three basic types—forested, shrub-dominated, and herb-dominated—then into various upland and lowland types. These categories are not intended to represent all major vegetation types in the state, nor is this listing designed to point out deficiencies in preservation. Numbers are those assigned preserves in the descriptions and in the Index List. Forest types are listed according to dominant species.

*Denotes unusually old-growth forest stands.

FORESTED

UPLAND

Hardwood:

Beach/maple—13, 28, 31, 34, 42, 54, 66, 80, *87, 89, 97, 111, 113, 121, 125, *136, 144, *145, 143.

Oak, oak/hickory—1, 2, 10, *21, 28, 30, 41, 42, 48, 54, 62, 72, 81, 83, 91, 97, 104, 144, 149, 154.

Poplar, aspen—12, 14, 16, 47, 49, 51, 52, 54, 73, 79, *82, 97, 109, 118, 119, 133, 139.

Mixed—3, 6, 13, 40, 44, 51, 52, 53, 68, 71, 72, 76, 79, 99, 106, 113, *142, 151.

Conifer:

White, red pine—*11, 12, 47, 51, 79, 88, 90, 99, 108, *114, 119, 128, 129, 130, 140, *150.

Jack pine—51, 52, 60, 108, 114.

Hemlock—4, 25, 44, 51, 79, 100, 118, 131.

Spruce/fir—46, 50, 51, 52, 55, 58, 93.

Mixed—63, 100, 110, 118, 119, 133.

Hardwood-Conifer:

Hemlock/northern hardwoods—12, 14, 24, 25, *27, 34, 35, 51, 60, 65, 68, 69, 73, 75, 88, 92, 98, *99, 103, 118, 126, 127, *130, 131, 141, 143, 152.

Other—18, 22, 39, 57, 68, 74, 78, 135, 138, 147, 156.

LOWLAND

Hardwood:

Elm/ash—10, 12, 16, 28, 42, 123, 129.

Mixed, other—2, 13, 31, 41, 54, 67, 71, 72, 84, 94, 100, 104, *145, 149, 151.

Conifer:

White cedar—2, 3, 12, 20, 22, *25, *27, 37, 38, 40, 47, 52, 53, 63, 66, 67, 74, 79, 80, 118, 119, 130, 131, 139, 147, 152.

Tamarack—2, 10, 12, 29, 41, 54, 66, 71, 84, 94, 99, 104, 116, 118, 119, 121, 128, 137, 146.

Mixed, other—14, 17, 34, 51, 73, 99, 108, 124, 140.

Hardwood-Conifer: 2, 9, 42, 76, 120, 131, 135, *148.

SHRUB-DOMINATED

UPLAND

Old field—70, 76, 77, 84, 111.

Thin soil—17, 46, 52, 53, 58, 59.

LOWLAND

Shrub swamp/carr—1, 9, 10, 12, 21, 23, 48, 54, 66, 71, 72, 79, 108, 120, 146, 151, 153, 154.

HERB-DOMINATED

UPLAND

Old field—6, 10, 18, 21, 41, 54, 76, 77, 101, 104, 105, 111, 120, 122, 137.

Open dune—11, 22, 45, 60, 63, 65, 75, 80, 92, 129, 133, 141, 144, 147.

Thin soil—17, 46, 50, 51, 52, 53, 58, 59, 93, 99.

Prairie—1, 2, 5, 7, 8, 33, 43, 61, 70, 71, 81, 85, 86, 96, 107, 115, 117, 132.

LOWLAND

Sphagnum bog—3, 12, 29, 37, 41, 51, 52, 65, 74, 76, 79, 84, 94, 104, 108, 118, 119, 128, 130, 141.

Wet prairie, fen—1, 5, 7, 8, 19, 23, 43, 56, 65, 154.

Marsh—2, 6, 10, 12, 18, 19, 21, 23, 26, 37, 41, 56, 62, 64, 65, 66, 70, 72, 77, 78, 84, 91, 97, 108, 109, 116, 118, 119, 120, 121, 122, 123, 134, 135, 148, 155.

Wet shore, beach pools—11, 22, 30, 40, 55, 58, 59, 60, 80, 82, 93, 129, 147.

APPENDIX E

Areas with Ambiguous Status and Partial Protection

American Lotus Plant Preserve (Michigan Nature Assoc.)—undergoing active planting for re-establishment of lotus.

Bear Lake Natural Area (Michigan State Univ.)—purchased with implied intent of preserving a bog lake, but no formal statement of such intent has been found.

Beaver Basin (Pictured Rocks National Lakeshore)—presently zoned "primitive," but a possible candidate for Federal Wilderness recommendation.

Bicentennial Woods (Lenawee Co.)—reported to contain a twenty-acre virgin hardwood forest, but lacks formal resolution for preservation.

Carp River (Hiawatha National Forest)—proposed through RARE II as Federal Wilderness.

Chase S. Osborn Tract (Univ. of Michigan)—a large tract (3200 acres) on Sugar Island, Chippewa Co., administered by the Biological Station with limited forest management.

- Dinosaur Hill Nature Preserve (City of Rochester)—lacks restrictive use guidelines; administered as "park" property.
- Edwin S. George Reserve (Univ. of Michigan)—a large tract in Livingston Co. maintained in a natural state except for deer herd manipulation and research.
- Ford Eagle Preserve (Ford Motor Company)—a protection agreement is pending with The Nature Conservancy.
- For-Mar Nature Preserve (Genesee Co.)—developed extensively for outdoor education.
- Government Island (Hiawatha National Forest)—proposed through RARE II as Federal Wilderness.
- Grayling Wilderness Preserve (Trout Unlimited)—possesses deed restrictions too vague to ensure preservation.
- Henry Ford Wildlife Area (Univ. of Michigan, Dearborn)—developed extensively for outdoor education.
- Hope College Dune Woodland Preserve (Hope College)—used as preserve but without formal designation or statement of intent.
- Horseshoe Bay (Hiawatha National Forest)—proposed through RARE II as Federal Wilderness.
- Kalamazoo Nature Center—created to preserve Cooper's Glen, but extensively developed for outdoor education on adjacent acreage.
- Kellogg Bird Sanctuary (Michigan State Univ.)—lacks formal designation as preserve.
- Kenneth W. and Timothy S. Gunn Memorial (Michigan Nature Assoc.)—a conservation easement over Fish Knob Point, Keweenaw County. (This represents a pioneering step in the use of such easements for natural area preservation in Michigan.)
- KirKelldel (Olivet College)—extensively developed and manipulated for ecological research.
- Kleinstuck Nature Preserve (Western Michigan Univ.)—lacks formal designation and use restrictions.
- Little Silver Addition (Ottawa National Forest)—proposed through RARE II as Federal Wilderness.
- Love Creek Nature Center (Berrien Co.)—intended primarily for outdoor education, though little developed.
- Marion Island (Grand Traverse Co.)—deed restriction allows "good forestry and wildlife management."
- Neithercut Woodland (Central Michigan Univ.)—developed extensively for outdoor education.
- Nordhouse Dunes (Manistee National Forest)—proposed through RARE II as Federal Wilderness.
- Orchid Haven Plant Preserve (Michigan Nature Assoc.)—has undergone planting of native orchids and partial reconstruction.
- Red Cedar Natural Area (Michigan State Univ.)—lacks formal preserve designation.
- Round Island (Hiawatha National Forest)—proposed through RARE II as Federal Wilderness. Dedicated as a "Scenic Area" by the Forest Service November 23, 1959. Management policy provides for no occupancy or other development, and no cutting except to control fire, insects, or disease.

- Sandhill Crane (private)—a program to attract cranes is carried on in informal cooperation with the Michigan Nature Association.
- Sanford Natural Area (Michigan State Univ.)—lacks formal preserve designation.
- Seiners Point (Mackinac State Forest)—a seven-mile stretch of diverse Lake Michigan shoreline whose dedication is being blocked by local opposition.
- Skegemog Lake Wildlife Area (Michigan DNR)—designated only to remain in a "natural appearing state."
- Sturgeon River (Ottawa National Forest)—proposed through RARE II as Federal Wilderness.
- Sylvania Recreation Area (U.S. Forest Service)—proposed through RARE II as Federal Wilderness.
- University of Michigan Biological Station Property—approximately 10,000 acres, some manipulative research; certain areas to be designated for long-term preservation and observation.
- Whitefish Point Bird Observatory (Michigan Audubon Society)—leased from U.S. Coast Guard on a five-year basis.

REFERENCES CITED

- Allen, D. 1979. *The Wolves of Minong: Their Vital Role in a Wild Community*. Houghton Mifflin, Boston.
- Ammann, G. A. 1957. *The Prairie Grouse of Michigan*. Dep. Conservation, Lansing. 200 pp.
- Beard, E. B. 1950. History of the Junction Marsh. *Jack-Pine Warbler* 28:102-113.
- Bergquist, S. G. 1931. Surface geology of Luce County, Michigan. *Pap. Mich. Acad.* 14:437-452.
- Bergquist, S. G. 1936. The Pleistocene History of the Tahquamenon and Manistique Drainage Region of the Northern Peninsula of Michigan. *Mich. Geol. Surv. Publ.* 40, Part 1. 148 pp.
- Billington, C. 1925. The flowering plants and ferns of Warren Woods, Berrien County, Michigan. *Pap. Mich. Acad.* 4:81-109.
- Brander, Robert B., et al. 1973. McCormick Experimental Forest Michigan. *Naturalist* 24(1), Spring. 32 pp.
- Braun, E. L. 1950. *Deciduous Forests of Eastern North America*. Blakiston, Philadelphia. 596 pp.
- Brewer, R., M. T. McCann, & J. C. Stiner. 1978. A Michigan naturalist's library. *Jack-Pine Warbler* 56:129-149.
- Brown, C. A. 1937. Ferns and Flowering Plants of Isle Royale, Michigan. U.S. Dep. Interior, Natl. Park Serv. 90 pp.
- Brownian Movement. 1977. University lands available to biologists. Univ. Mich., Div. Biol. Sci.
- Brubaker, L. B. 1975. Postglacial forest patterns associated with till and outwash in north-central upper Michigan. *Quat. Res.* 5:499-527.
- Buckman, R. E., & R. L. Quintus. 1972. *Natural areas of the Society of American Foresters*. Soc. Am. For., Washington.
- Bureau of Land Management. 1979a. BLM land facts; Michigan. U.S. Dep. Interior, Duluth.

- Bureau of Land Management. 1979b. Initial inventory proposals for public lands and islands in Minnesota. U.S. Dep. Interior, Alexandria.
- Cain, S. A. 1935. Studies on virgin hardwood forest: III. Warren Woods, a beech-maple climax forest in Berrien County, Michigan. *Ecology* 16:500-513.
- Catana, A. J., Jr. 1967. Forests of the Harvey N. Ott Preserve. *Am. Midl. Nat.* 78:496-507.
- Chapman, K. A., & R. J. Pleznac. 1978. A survey of prairie preservation and prairie reconstruction in Michigan. Paper presented at 7th Prairie Conference, Columbus, Ohio.
- Christy, B. H. (ed.). 1929. *The Book of Huron Mountain*. Huron Mountain Club. 216 pp.
- Churchill, J. A. 1976. *Eleocharis atropurpurea* in Michigan. *Mich. Bot.* 15:182.
- Cooper, W. S. 1913. The climax forest of Isle Royale, Lake Superior, and its development. *Bot. Gaz.* 55:1-44; 115-140; 189-235.
- Corin, C. W. 1976. The land vertebrates of the Huron Islands, Lake Superior. *Jack-Pine Warbler* 54:138-147.
- Crow, G. E. 1969a. An ecological analysis of a southern Michigan bog. *Mich. Bot.* 8:11-27.
- Crow, G. E. 1969b. A phytogeographical analysis of a southern Michigan bog. *Mich. Bot.* 8:51-60.
- Crow, G. E. 1969c. Species of vascular plants of Pennfield Bog, Calhoun County, Michigan. *Mich. Bot.* 8:131-136.
- Darlington, H. T. 1931. Vegetation of the Porcupine Mountains, northern Michigan. Part I. *Ecology. Pap. Mich. Acad.* 13:9-66.
- Darlington, H. T. 1937. Vegetation of the Porcupine Mountains, northern Michigan. Part II. *Floristics. Pap. Mich. Acad.* 22:33-68.
- Dodge, C. K. 1918. Observations on the Flowering Plants, Ferns and Fern Allies Growing Wild in Marquette County, Michigan, in 1916 and 1917, Especially in the Vicinity of the Huron Mountain Club. *Univ. Mich. Mus. Zool. Misc. Publ.* 5. 44 pp.
- Dodge, C. K. 1921. Observations on the wild plants at Whitefish Point and Vermilion, near the south shore of Lake Superior, and other parts of Chippewa County, Michigan, in 1914. *Mich. Geol. Biol. Surv. Publ.* 31:125-164.
- Dodge, P. 1961. Birds of the Huron Mountains, Marquette County, Michigan. *Jack-Pine Warbler* 39:3-33.
- Dutton, C. E. 1968. Summary Report on the Geology and Mineral Resources of the Huron, Seney, Michigan Islands, Green Bay, and Gravel Island National Wildlife Refuges of Michigan and Wisconsin. U.S. Geol. Surv. Bull. 1260-I. 14 pp.
- Environmental assessment for the Shiawassee National Wildlife Refuge (preliminary). n. d.
- Eshbach, C. 1976. Sawmill to Sanctuary. *The Estivant Pines Story*. North Forty Publ., Houghton. 30 pp.
- Federal Committee on Ecological Reserves. 1977. *A Directory of Research Natural Areas on Federal Lands of the United States of America*.
- Flaccus, E. 1972. Vegetation natural areas of the hemlock-white pine-northern hardwood region of the eastern deciduous forest. *Bennington Coll.*, Vermont.
- Getz, L. 1961a. Factors influencing the local distribution of shrews. *Am. Midl. Nat.* 65:67-88.
- Getz, L. 1961b. Notes on the local distribution of *Peromyscus leucopus* and *Zapus hudsonianus*. *Am. Midl. Nat.* 65:486-500.
- Getz, L. 1961c. Temperatures in different vegetation types in southern Michigan. *Jack-Pine Warbler* 39:132-147.
- Gilbert, W. J. 1954. The Harvey N. Ott Biological Preserve of Albion College. *Mich. History* 38:157-167.
- Good, D. 1977. Study of the breeding birds of the Martha Mott Sanctuary, Van Buren County. *Jack-Pine Warbler* 55:162-178.
- Grand Mere Association. 1973. *Grand Mere. A Very Special Place*. Kalamazoo Nature Center, Kalamazoo. 100 pp.
- Gunter, P. A. Y. 1978. Wilderness preservation. *Phi Kappa Phi Jour.* 58 (winter): 36-40.
- Hagenah, D. J. 1963. Pteridophytes of the Huron Mountains, Marquette County, Michigan. *Mich. Bot.* 2:78-93.
- Hansen, H. L., L. W. Krefting, & V. Kurmis. 1973. The Forest of Isle Royale in Relation to Fire History and Wildlife. *Minn. Agr. Exp. Sta. Tech. Bull.* 294 (For. Ser. 13). 43 pp.

- Hatt, Robert T., et al. 1948. *Island Life: A Study of the Land Vertebrates of the Islands of Eastern Lake Michigan*. Cranbrook Inst. Sci. Bull. 27. 179 pp.
- Hauser, R. S. 1953. An Ecological Analysis of the Isolated Prairies of Newaygo County, Michigan. Ph. D. thesis, Mich. State Univ.
- Heatwole, H., & L. Getz. 1960. Studies on the amphibians and reptiles of Mud Lake Bog in southern Michigan. *Jack-Pine Warbler* 38:107-112.
- Hedrick, J., & J. L. Lowe. 1936. Lichens of Isle Royale, Lake Superior. *Bryologist* 39: 73-91.
- Heinselman, M. L. 1965. String bogs and other patterned organic terrain near Seney, upper Michigan. *Ecology* 46:185-188.
- Huber, N. K. 1973a. Glacial and Postglacial Geologic History of Isle Royale National Park, Michigan. U.S. Geol. Surv. Prof. Pap. 754-A. 15 pp.
- Huber, N. K. 1973b. The Portage Lake Volcanics (Middle Keweenaw) on Isle Royale, Michigan. U.S. Geol. Surv. Prof. Pap. 754-C. 32 pp.
- Huber, N. K. 1975. The Geologic Story of Isle Royale National Park. U.S. Geol. Surv. Bull. 1309. 66 pp.
- Humke, J. W. 1970. A Comparative Study of Four State Natural Areas Systems with Recommendations for Michigan. M. S. thesis, Mich. State Univ.
- Huron Mountain Wildlife Foundation. 1967. Report 1955-1966 with Bibliography and Related Material. 96 pp.
- International Union for the Conservation of Nature and Natural Resources. 1975. *World Directory of National Parks and Other Protected Areas. I*. U. C. N., Morges, Switzerland.
- Kapp, R. O. 1969. Natural area preservation in the age of the megalopolis. *Mich. Bot.* 8:30-35.
- Krefting, L. W., F. B. Lee, P. C. Shelton, & K. T. Gilbert. 1966. Birds of Isle Royale in Lake Superior. U.S. Dep. Interior, Fish Wildl. Serv., Bur. Sport Fish. Wildl. Spec. Sci. Rep.—Wildl. 94. 56 pp.
- Krefting, L. W., H. L. Hansen, & M. P. Meyer. 1970. Vegetation Type Map of Isle Royale National Park. U.S. Dep. Interior, Bur. Sport Fish. Wildl.
- Krefting, L. W. 1974. The Ecology of the Isle Royale Moose with Special Reference to the Habitat. *Minn. Agr. Exp. Sta. Tech. Bull.* 297 (For. Ser. 15). 75 pp.
- Laundre, John. [1975]. An Ecological Survey of the Mammals of the Huron Mountain Area. Occ. Pap. Huron Mt. Wildl. Found. 2. 69 pp.
- Leopold, A. 1949. *A Sand County Almanac and Sketches Here and There*. Oxford Univ. Press, New York. 226 pp.
- Leverett, F. 1917. Surface Geology and Agricultural Conditions of Michigan. *Mich. Geol. Biol. Surv. Publ.* 21. 223 pp.
- Leverett, F. 1929. Moraines and Shore Lines of the Lake Superior Basin. U.S. Geol. Surv. Prof. Pap. 154-A. 72 pp.
- Lindsey, A. A., & L. K. Escobar. 1976. Eastern Deciduous Forest Volume 2 Beech-Maple Region. Inventory of Natural Areas and Sites Recommended as Potential Natural Landmarks. U.S. Dep. Interior Natl. Park Serv. Nat. Hist. Theme Stud. 3. 238 pp.
- Lindsey, A. A., D. V. Schmelz, & S. A. Nichols. 1969. Natural Areas in Indiana and their Preservation. Indiana Natural Areas Survey, Purdue University, Lafayette. 594 pp.
- Long Lake Preservation Association. n. d. Articles of Incorporation.
- MacDonald, R. L., P. A. Delcourt, & R. O. Kapp. 1971. Plant communities of the MacCurdy Ecological Tract, Montcalm County, Michigan. *Mich. Academ.* 4:17-28.
- Manville, R. H. 1948. The vertebrate fauna of the Huron Mountains, Michigan. *Am. Midl. Nat.* 39:615-640.
- Mech, L. D. 1966. The Wolves of Isle Royale. *Fauna Natl. Parks U.S. Fauna Ser.* 7. 210 pp.
- Messner, C. J., & R. C. Messner. 1946. "Riverbank" The Jennie Putnam Wildlife Sanctuary at Manistique, Michigan. *Jack-Pine Warbler* 24:140-144.
- Michigan Natural Areas Council. 1978. AMTRAK prairie remnant reconnaissance report.
- Michigan Natural Areas Council. 1979a. Reconnaissance, Site, and Other Reports Volume 1, 1950-1977. Univ. Microfilms Internatl., Ann Arbor. 486 pp.
- Michigan Natural Areas Council. 1979b. Dayton Prairie reconnaissance report.
- Michigan Natural Areas Council. 1979c. Kasey Hartz natural area reconnaissance report.

- Michigan Nature Association. 1977. Sanctuary Guide. Mich. Nat. Assoc., Mt. Clemens.
- Michigan Nature Association. 1979a. Brockway Mountain Nature Sanctuary. 2 pp.
- Michigan Nature Association. 1979b. James H. Klipfel Memorial Nature Sanctuary. 2 pp.
- Michigan Nature Association. 1979c. Rare Fern Plant Preserve. 2 pp.
- Michigan Nature Association. 1979d. Two Wilderness Islands Nature Sanctuary. 2 pp.
- Migratory Bird and Habitat Research Laboratory. 1978. Progress report on the evaluation of Seney National Wildlife Refuge fire on wildlife and wildlife habitat. Laurel, Maryland.
- Mosely-Bennett-Barlow Stewardship Committee. 1979. Mosely-Bennett-Barlow Preserve master plan. Nature Conserv., Mich. Field Off., Lansing.
- National Wildlife Refuge Study Task Force. 1979. Final recommendations on the management of the National Wildlife Refuge System. U.S. Dep. Interior, Fish Wildl. Serv.
- Natural Areas Association. 1979. Definition of a natural area. Nat. Areas Assoc. Newsl. September.
- Natural Areas Conservancy of West Michigan, Inc. n.d.
- Nature Conservancy. 1977. Preserving Our Natural Heritage Vol. 1. Federal Activities.
- Nature Conservancy, Michigan Field Office. 1977. Michigan Accomplishments of The Nature Conservancy.
- Nature Conservancy, Michigan Field Office. 1978a. Hoobler Natural Area master plan.
- Nature Conservancy, Michigan Field Office. 1978b. Palmer-Wilcox-Gates Preserve master plan.
- Nature Conservancy, Michigan Field Office. 1979. Erie Marsh Preserve master plan.
- Nichols, G. E. 1935. The bryophytes of Michigan with special reference to the Huron Mountain region. *Bryologist* 38:11-19.
- Nichols, G. E., & W. C. Steere. 1937. Bryophytes of the Porcupine Mountains, Ontonagon County, Michigan. *Pap. Mich. Acad.* 22:183-200.
- Nichols, G. E. 1938. Bryophytes of the Huron Mountain region Marquette County, Michigan. *Bryologist* 41:24-31.
- Ohio, State of, & The Nature Conservancy. 1977. Ohio natural heritage program technical report. Ohio Dep. Nat. Res., Columbus.
- Pennington, L. H. 1906. Plant distribution at Mud Lake. *Rep. Mich. Acad.* 8:54-63.
- Peterson, R. O. 1977. Wolf Ecology and Prey Relationships on Isle Royale. *Natl. Park Serv. Sci. Monogr. Ser.* 11. 210 pp.
- Pettingill, O. S., Jr., R. R. Graber, & J. W. Graber. 1957. The summer birds of Wilderness State Park, Michigan. *Jack-Pine Warbler* 35:42-63.
- Povah, A. H. W. 1935. The fungi of Isle Royale, Lake Superior. *Pap. Mich. Acad.* 20: 113-156.
- Public Acts of Michigan, Act. 241. Wilderness and Natural Areas Act. Mich. Comp. Laws Tit. 13, Sect. 13.734.
- Raisanen, R. A., & J. K. Werner. 1977. A Survey of Fishes of the McCormick Forest. U.S. Dep. Agr. For. Serv. Res. Pap. NC-147. 10 pp.
- Reveal, J. L., & C. R. Broome. 1979. Plant rarity; real and imagined. *Nat. Conserv. News* 29 (Mar./Apr.):4-8.
- Robinson, W. L., & J. K. Werner. 1975. Vertebrate Animal Populations of the McCormick Forest. U.S. Dep. Agr. For. Serv. Res. Pap. NC-118. 25 pp.
- Ruthven, A. G., et al. 1906. An Ecological Survey in the Porcupine Mountains and Isle Royale, Michigan. *Rep. Geol. Surv. Mich.* 1905. 133 pp.
- Schneider, G. 1966. A Twenty-year Ecological Investigation in a Relatively Undisturbed Sugar Maple-Beech Stand in Southern Michigan. *Mich. Agr. Exp. Sta. Res. Bull.* 15. 61 pp.
- Schnell, G. D. 1967. Additional notes on the birds of Wilderness State Park. *Jack-Pine Warbler* 45:66-67.
- Shelton, N. 1975. The Life of Isle Royale. U.S. Dep. Interior, Natl. Park Serv., Nat. Hist. Ser. 142 pp.
- Stanley, K. P. 1978. West Wequetonsing Nature Preserve master plan. Nature Conservancy, Michigan Field Office, Lansing.

- Stearns, F., & D. Lindsley. 1977. Environmental Status of the Lake Michigan Region Vol. II. Natural Areas of the Lake Michigan Drainage Basin and Endangered or Threatened Plant and Animal Species. Argonne Natl. Lab., Argonne, Illinois.
- Tague, G. C. 1947. The Post-Glacial Geology of the Grand Marais Embayment, Berrien County, Michigan. Mich. Geol. Surv. Publ. 45, Part 1. 82 pp.
- Thompson, P. W. 1970. A wet prairie community in Ann Arbor, Michigan. Mich. Academ. 2:87-94.
- Thompson, P. W. 1976. The Michigan Natural Areas Council program and its early history. Mich. Bot. 15:93-98.
- Thompson, W. L. 1973. Enjoying Birds in Michigan. Mich. Audubon Soc., Kalamazoo.
- Thorpe, F. J., & A. H. Povah. 1935. The bryophytes of Isle Royale, Lake Superior. Bryologist 38:32-46.
- Ulrich, K. E. 1979. Net Productivity and Biomass of a Mature Southern Michigan Bog. M. S. thesis, Mich. State Univ.
- Urban & Environmental Studies Institute. 1977. Kitchel Dune Preserve feasibility study. Grand Valley State Coll., Allendale.
- U.S. Code, Title 16, Sect. 1131-1133. 1976. Wilderness Act. Publ. Law 85-577, Sept. 3, 1964, 78 Stat. 896.
- U.S. Department of Agriculture, Forest Service. 1968. Sylvania Recreation Area management plan. Ottawa National Forest.
- U.S. Department of Agriculture, Forest Service. 1974. Establishment report for Grand Island Research Natural Area within the Hiawatha National Forest. North Central For. Exp. Sta.
- U.S. Department of Interior, Fish & Wildlife Service, Bureau of Sport Fisheries & Wildlife. [1967a]. Huron Islands & Seney Wilderness Study Areas.
- U.S. Department of Interior, Fish & Wildlife Service, Bureau of Sport Fisheries & Wildlife. [1967b]. Michigan Islands Wilderness Study Area.
- U.S. Department of Interior, Fish & Wildlife Service, Bureau of Sport Fisheries & Wildlife. 1970. Wildlife refuge handbook 4—refuge system objectives.
- U.S. Department of Interior, Fish & Wildlife Service. 1978. Seney master plan summary.
- U.S. Department of Interior, Fish & Wildlife Service, Bureau of Sport Fisheries & Wildlife. 1979. Seney and Huron Islands Wilderness Areas.
- Walkinshaw, L. H. 1941a. The Bernard W. Baker Sanctuary of the Michigan Audubon Society. Jack-Pine Warbler 19:98-103.
- Walkinshaw, L. H. 1941b. A list of birds which have been observed at the Bernard W. Baker Sanctuary area. Jack-Pine Warbler 19:106-128.
- Walkinshaw, L. H. 1961. Additions to the list of birds observed on the Bernard W. Baker Sanctuary. Jack-Pine Warbler 39:100-124.
- Walkinshaw, L. H. 1962. Kiwanis Lake at Baker Sanctuary. Jack-Pine Warbler 40:134-135.
- Walkinshaw, L. H. 1973. A history of sandhill cranes on the Haehnle Sanctuary, Michigan. Jack-Pine Warbler 51:54-74.
- Wells, J. R., & P. W. Thompson. [1976]. Vegetation and Flora of the Huron Mountains. Occ. Pap. Huron Mt. Wildl. Found. 3. 59 pp.
- Willis, G. L., & M. S. Coffman. [1975]. Composition, Structure, and Dynamics of Climax Stands of Eastern Hemlock and Sugar Maple in the Huron Mountains, Michigan. Mich. Tech. Univ. Dep. For. Tech. Bull. 13. 43 pp.
- Wing, H. 1955. The Phyllis Haehnle Memorial Sanctuary. Jack-Pine Warbler 33:2-4.
- Wolff, R. G., & N. K. Huber. 1973. The Copper Harbor Conglomerate (Middle Keweenawan) on Isle Royale, Michigan, and Its Regional Implications. U. S. Geol. Surv. Prof. Pap. 754-B. 15 pp.

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155. Wyandotte National Wildlife Refuge
156. Zeerip Drummond Island Memorial Plant Preserve

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BY THE MICHIGAN BOTANICAL CLUB
AND THE MICHIGAN NATURAL AREAS COUNCIL
AND DEDICATED TO THE MEMORY OF
CLARENCE J. MESSNER
(1902-1979)

Long an active, conscientious, and imaginative member and officer of the Michigan Botanical Club, the Michigan Natural Areas Council, and the Michigan Audubon Society, among many organizations; member of the Michigan Conservation Commission, 1958-1964 (chairman, 1964); Clarence dreamed of an inventory such as this, among his many visions for the conservation movement in Michigan.

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WKS
**BRYOPHYTES OF MOUNT LOOKOUT,
KEWEENAW COUNTY, MICHIGAN**

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In 1974, Wells & Thompson reported on the vegetation and flora of Keweenaw County and pointed out that tourism is likely to be the next principal expansion there and that such activity will have a profound and lasting effect on the native biota. As the higher plants are affected, the bryophyte flora will likewise be altered, either directly or, by the disturbance of the other vegetation, indirectly.

The Keweenaw Peninsula was recognized as botanically unique and interesting by Fernald (1935) and subsequently studied by Steere (1934, 1937, 1938, 1945), who found the area of equal interest with regard to rare and disjunct bryophytes. Cordilleran, Pacific Coast, and Arctic elements provide for interesting speculation as to whether their presence can be explained by the same phenomena as that of the phanerogams can. In spite of the fascinating possibilities for study of Keweenaw bryophytes, no single area seems to have been explored in depth, and certainly some of the more interesting areas have been missed altogether by Michigan bryologists.

The Lookout Mountain range was discussed by Steere (1937) as one of the highlands of Keweenaw County where the "bryophyte flora is almost completely unknown, although presumably of little interest." This conjecture was based on the fact that the cliffs face south and are therefore quite arid. Nevertheless, indentations and corners provide cooler shaded areas where less sun-tolerant species can succeed. Certainly these high areas which Fernald suggested might have escaped glacial denuding have potential phytogeographic interest.

Mount Lookout (N47°28', W88°7') is a 407 m high buff known locally as Mount Baldy. It lives up to that name by having bare escarpments with only scattered low plants and an occasional dwarfed northern red oak or white spruce.



Fig. 1. Sparse vegetation cover at top of Mount Lookout. Fig. 2. A typical habitat for bryophytes, among rocks exposed to the elements.

The escarpment consists of a mixed, dark reddish-brown Middle Conglomerate which is largely basalt with calcareous cementing substances. Calcareous materials are rare in the Keweenaw Peninsula, and likewise so are calciphiles. Nevertheless, where tiny patches of calcium-laden cement are exposed, one can hope to find calciphilic bryophytes, and these include several species which are tolerant of such dry southern exposures.

Wells & Thompson listed 37 higher plants from the summit of the mountain. We restricted our study to the horizontal "meadows" and the south-facing slopes and thus eliminated the denser tree and shrub areas described by Wells & Thompson. We included only bare areas and areas of such limited protection as afforded by junipers (*Juniperus communis* var. *depressa*, *J. horizontalis*), buffalo berry (*Shepherdia canadensis*), bearberry (*Arctostaphylos uva-ursi*), prickly rose (*Rosa acicularis*), and

dwarfed trees—balsam fir (*Abies balsamea*), white spruce (*Picea glauca*), white pine (*Pinus strobus*), white cedar (*Thuja occidentalis*), and northern red oak (*Quercus borealis*). With this restriction, we had a phanerogamic cover of only 32 species, including herbs. To the Wells & Thompson's list we added thinleaf bilberry (*Vaccinium membranaceum*), draba (*Draba arabisans*—reported also by Fernald, 1935), red clover (*Trifolium pratense*), smooth sumac (*Rhus glabra*), hepatica (*Hepatica americana*), violet (*Viola* sp.), yellow honeysuckle (*Lonicera flava*), picris (*Picris hieracioides*), and wormwood (*Artemisia campestris* ssp. *borealis*).

Because of the patterns of the wind, two distinct habitats can be recognized by a casual observer. On the exposed tops of the bluffs nearly continuous winds carry moist air from Lake Superior and provide a noticeably colder habitat, whereas the shrub and dwarf tree community of the meadow is protected. (One is easily enticed to enjoy lunch there on a grass or lichen carpet out of the chilling wind.) A third community occupies dry, vertical, south-facing bluffs. The three communities were studied closely to delimit bryophyte associations and search for western disjuncts or other unusual species. Bryophytes were collected in July, September, and October, and the Mount Lookout exsiccata of C. D. Richards (MTU Cryptogamic Herbarium) were studied. Richards collected six species at the summit in 1949; four of them could not be relocated in 1977–78.

The vertical bluffs support a few phanerogams such as *Poa*, *Deschampsia*, *Draba*, *Viola*, *Aster*, and *Artemisia*, where a crevice is sufficiently large to house a root system. Conspicuous are such lichens as crustose *Xanthoria* and *Rhizocarpon* and foliose *Hypogymnia*. Four species of bryophytes could be located on the vertical walls, especially in crevices on the west-facing indentation of the bluff. *Encalypta procer*a (also collected by Richards) and *Tortella humilis* occurred primarily in crevices on the west-facing wall, where they were associated with calcium cements. These mosses could not be seen around the corner on the south-facing bluff where detailed examination was not possible without endangering one's life. As one might expect, *Grimmia apocarpa* occurred abundantly on both the west- and south-facing walls where it lived up to its capabilities to withstand dry, exposed habitat conditions. *Heteocladium dimorphum* occurred on calcium patches in crevices where it apparently found sufficient moisture to maintain its more mesic requirements.

Grimmia alpicola, while apparently not present on vertical bluffs, was found scattered on the more gently sloping portion of the edge, sometimes hiding with *Tortella humilis* under a wormwood stem. *Tortula ruralis*, another calciphile, was also able to grow here. *Hedwigia ciliata*, collected by Richards on open rocky areas such as this, could not be relocated. The unstable nature of the slopes and the presence of many hikers could have eliminated this species in the intervening 29 years.

At the tops of the bluffs where cold winds keep higher plants at a minimum, bearberry and junipers provide occasional low cover. Here one

can find *Dicranum scoparium* with the liverwort *Ptilidium pulcherrimum* climbing over it. *Polytrichum juniperinum* and *P. piliferum* grow in both protected and open areas, as do *Grimmia apocarpa* and *Ceratodon purpureus*. The latter was also found among charcoals of a campfire site. Other mosses of less abundance include *Bryum capillare* on soil, *Thuidium abietinum* on rock shaded by another rock, *Tortella humilis* and *Tortula ruralis* on rocks, and *Pseudoleskea patens* on wood (also found by Richards on rock). *Pseudoleskea patens* is a subarctic species (Steere, 1938) known in Michigan only from Keweenaw County. In addition to these, Richards found *Mnium cuspidatum*, *Anomodon rostratus*, and *Paraleucobryum longifolium* on the rocks.

On the leeward side of the summit in the low shrub meadow the number of bryophyte species is about the same as in the windy area, but the species are different and require much more searching to find them hidden under branches, on roots, or on the bark and bases of trees. They include *Ptilidium pulcherrimum*, *Brachythecium acuminatum*, *B. flexicaule*, *Dicranum fuscescens*, *D. polysetum*, *Eurhynchium pulchellum*, *Heterocladium dimorphum*, *Hypnum pallescens*, *Pleurozium schreberi*, and *Rhynchostegium serrulatum*. It should be noted that *Brachythecium flexicaule* has been reported infrequently in Michigan, in the Upper Peninsula only from Chippewa and Houghton Counties. Keweenaw County collections made by Margaret Feigley (MTU Cryptogamic Herbarium) include a number of additional records.

The bryophytes found on Mount Lookout, while not representing rare disjuncts, number 26 and include some which are locally uncommon. The calciphiles, in particular, are of interest because so little exposed calcium is present in the Keweenaw Peninsula. Perhaps it is only in areas so inhospitable to higher plants that the bits of calcium cementing together the conglomerate are sufficiently exposed and uncolonized to provide opportunity for these mosses to establish themselves.

The authors thank Howard Crum and Barbara Hoisington for help in identification. Specimens collected by C. D. Richards were identified by W. C. Steere. Voucher specimens are in the Michigan Technological University Cryptogamic Herbarium.

LITERATURE CITED

- Fernald, M. L. 1935. Critical plants of the upper Great Lakes region of Ontario and Michigan. Part I. The pre-Wisconsin flora of the Upper Great Lakes region. *Rhodora* 37(438): 197-222, 238-262, 272-301, 324-341.
- Steere, W. C. 1934. Unreported or otherwise interesting bryophytes from Michigan. *Bryol.* 37(3):57-62.
- . 1937. Critical bryophytes from the Keweenaw Peninsula, Michigan. *Rhodora* 39: 1-14; 33-46.
- . 1938. Critical bryophytes from the Keweenaw Peninsula, Michigan, II. *Ann. Bryol.* 11:145-152.
- . 1945. The bryophyte flora of Michigan. *Papers Mich. Acad. Sci.* 31:33-56.
- Wells, J. R. & P. W. Thompson. 1974. Vegetation and flora of Keweenaw County, Michigan. *Mich. Bot.* 13:107-151.

CHECK LIST AND DISTRIBUTIONS OF WISCONSIN
FERNS AND FERN ALLIES

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The ferns and fern allies are well represented in the Great Lakes region. Their remarkable diversity and abundance have attracted considerable attention over the past 100 years. The last treatment of Wisconsin pteridophytes (Tryon et al., 1953) is now out of print and much in need of revision. Changes in nomenclature and continued collection make necessary a new inventory based on herbarium search and field survey. In that it will take at least several years to complete, we think it desirable to present a preliminary checklist, together with up-dated information on distribution. The final flora will include illustrations, descriptions, habitats, keys, and phytogeographic analysis. Until then, the manuals of Wherry (1961) and Mickel (1979) are recommended.

The checklist and distribution maps are based on more than 17,000 specimens in 26 herbaria: Apostle Islands Nat. Seashore, Devil's Lake State Park, Iowa State Univ., Mankato State Univ., Milwaukee Public Museum, Morton Arboretum, Nicolet College, Northland College, Oshkosh Public Museum, Pigeon Lake Field Station, Univ. of Iowa, Univ. of Minnesota—St. Paul, Univ. of Wisconsin Center—Baraboo, Univ. of Wisconsin Center—Sheboygan Co., Univ. of Wisconsin—Green Bay, Univ. of Wisconsin—La Crosse, Univ. of Wisconsin—Madison, Univ. of Wisconsin—Milwaukee, Univ. of Wisconsin—Oshkosh, Univ. of Wisconsin—Platteville, Univ. of Wisconsin—River Falls, Univ. of Wisconsin—Rock Co., Univ. of Wisconsin—Stevens Point, Univ. of Wisconsin—Superior, Univ. of Wisconsin—Whitewater, Viterbo College, and the private herbarium of William Tans (Madison).

Taxonomic reports consulted to identify material, determine the correct name, or resolve taxonomic problems include the following: *Asplenium* and *Camptosorus* (Mickel, 1974; Wagner, 1954), *Athyrium* (Liew, 1972), *Azolla* (Svenson, 1944), *Botrychium* (Wagner, 1959, 1960; Wagner & Lord, 1956), *Cystopteris* (Blasdell, 1963), *Dennstaedtia* (Tryon, 1960), *Dryopteris* (Fraser-Jenkins & Jermy, 1977; Carlson, 1979; Wagner, 1971), *Equisetum* (Hauke, 1963, 1965, 1966, 1974, 1978), *Gymnocarpium* (Sarvela, 1978; Wagner, 1966), *Isoetes* (Løve, 1962; Pfeiffer, 1922), *Lycopodium* (Beitel, 1979; Hickey, 1977; Hickey & Beitel, 1979; Wilce, 1965), *Matteuccia* and *Onoclea* (Lloyd, 1971), *Pellaea* (Tryon, 1957), *Phegopteris* (Mulligan, Cinq-Mars & Cody, 1972), *Polypodium* (Fernald, 1922), *Polystichum* (Fernald, 1928), *Pteridium* (Tryon, 1941), *Selaginella* (Buck, 1977; Tryon, 1955), *Thelypteris* (Tryon & Tryon, 1973), and *Woodsia* (Brown, 1964).

The list is arranged according to Crabbe, Jermy, & Mickel (1975). Additions since Tryon et al. (1953) are marked with an asterisk. When names differ from those used in

regional manuals, the synonyms are presented within brackets and annotated with a letter code: F = Fernald (1950), G = Gleason & Cronquist (1963), M = Mickel (1979), T = Tryon et al. (1953), and W = Wherry (1961).

The distribution maps summarize county-occurrence. They are arranged alphabetically by binomial. Names of the 72 Wisconsin counties are given in the following map:



Fig. 1. Wisconsin's counties.

We report a flora of 105 taxa in 12 families and 27 genera: 82 species, 20 hybrids, two species represented by two varieties, and one species represented by two forms. The flora includes 17 taxa recognized as additions to the previous state treatment (Tryon et al., 1953); 11 hybrids, five species, and one variety. Although the list is relatively complete, we expect that additional species will be added through continued field efforts, particularly in the four corners of the state. Intraspecific names are not reported for several species, including *Athyrium angustum*, *Lycopodium annotinum*, and *Lycopodium clavatum*. These species require additional observations on habitats, phenology, geography, and biosystematics before sound judgments on infraspecific categories can be made.

Several species require additional collecting before an adequate representation of their Wisconsin distribution can be mapped. All *Botrychium* species,

except for *B. virginianum*, need survey in eastern Wisconsin. *Dryopteris* hybrids require more attention in the northern and central part of the state. Three *Lycopodium* complexes require field study: *L. dendroideum/obscurum* var. *isophyllum/obscurum* var. *obscurum*; *L. complanatum/digitatum/tristachyum*; and *L. lucidulum/porophilum/selago*. Care must be given to distinguish between hybrids and environmentally induced variation.

Additional efforts are needed to verify whether six taxa are still present in the state. Four of them are known only from collections made in the 1800's or early 1900's: *Cheilanthes lanosa*, *Dryopteris clintoniana*, *Dryopteris Xslossonae*, and *Woodsia Xabbeae*. Two species found more recently require field observation to determine if they are merely transient populations: *Dennstaedtia punctilobula* and *Dryopteris filix-mas*.

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LYCOPODIOPHYTA

LYCOPODIACEAE

- Lycopodium annotinum* L. (Stiff Clubmoss)
- L. clavatum* L. (Running Clubmoss)
- L. complanatum* L. (Flat-branched Clubmoss)
- L. dendroideum* Michx. (Round-branched Groundpine)
 - [*L. obscurum* var. *dendroideum* (Michx.) D. C. Eat. ex A. Gray (F,G,T,W)]
- L. digitatum* A. Br. (Crowfoot Clubmoss)
 - [*L. complanatum* var. *flabelliforme* Fern. (F,G,T)]
 - [*L. flabelliforme* (Fern.) Blanch. (M,W)]
- L. inundatum* L. (Bog Clubmoss)
- L. lucidulum* Michx. (Shining Clubmoss)
- **L. obscurum* var. *isophyllum* Hickey (Intermediate Groundpine)
 - [*L. obscurum* L. (F,G,M,T,W)]
- L. obscurum* L. var. *obscurum* (Flat-branched Groundpine)
 - [*L. obscurum* L. (F,G,M,T,W)]
- L. porophilum* Lloyd & Underw. (Rock Clubmoss)
 - [*L. selago* var. *patens* (Beauv.) Desv. (G,T)]
- L. selago* L. (Fir Clubmoss)
- L. tristachyum* Pursh (Ground-cedar Clubmoss)
- L. Xhabereri* House (*L. digitatum* X *tristachyum*)
 - [*L. tristachyum* var. *habereri* (House) Vict. (T)]
- **L. Xzeileri* (Rouy) Vict. (*L. complanatum* X *tristachyum*)
- **L. complanatum* X *digitatum*
- **L. lucidulum* X *porophilum*
- **L. lucidulum* X *selago*

SELAGINELLACEAE

Selaginella eclipses Buck (Northern Meadow Spikemoss)

[*S. apoda* (L.) Fern. F,G,T)]

[*S. apus* (L.) Spring. (W)]

S. rupestris (L.) Spring. (Rock Spikemoss)

S. selaginoides (L.) Link (Northern Spikemoss)

ISOETES

Isoetes echinospora Dur. (Spiny-spored Quillwort)

[*I. muricata* Dur. (F,T,W)]

I. macrospora Dur. (Lake Quillwort)

EQUISETOPHYTA

EQUISETACEAE

Equisetum arvense L. (Field Horsetail)

E. fluviatile L. (Water Horsetail)

E. hyemale var. *affine* (Engelm.) A. A. Eat. (Common Scouring-rush)

E. laevigatum A. Br. (Smooth Scouring-rush)

[*E. kansanum* Schaffn. (F,T)]

E. palustre L. (Marsh Horsetail)

E. pratense Ehrh. (Meadow Horsetail)

E. scirpoides Michx. (Dwarf Scouring-rush)

E. sylvaticum L. (Woodland Horsetail)

E. variegatum Schleich. (Variegated Scouring-rush)

E. ×ferrissii Clute (*E. hyemale* × *laevigatum*)

[*E. hyemale* var. *intermedium* A. A. Eat. (F)]

[*E. laevigatum* A. Br. (T)]

E. ×litorale Kuhlw. (*E. arvense* × *fluviatile*)

E. ×nelsonii (A. A. Eat.) Schaffn. (*E. laevigatum* × *variegatum*)

[*E. variegatum* var. *nelsonii* A. A. Eat. (F,G,W)]

[*E. nelsonii* (A. A. Eat.) Schaffn. (T)]

**E. ×trachyodon* A. Br. (*E. hyemale* × *variegatum*)

[*E. variegatum* var. *jesupi* A. A. Eat. (F,G,W)]

POLYPODIOPHYTA

OPHIOGLOSSACEAE

Botrychium dissectum Spreng. f. *dissectum* (Dissected Grape Fern)

[*B. dissectum* var. *dissectum* (G)]

B. dissectum f. *obliquum* (Muhl.) Fern. (Oblique Grape Fern)

[*B. dissectum* var. *obliquum* (Muhl.) Clute (G)]

[*B. obliquum* Muhl. (W)]

B. lanceolatum var. *angustisegmentum* Pease & Moore (Triangle Grape Fern)

B. lunaria (L.) Sw. (Moonwort)

B. matricariifolium A. Br. ex Koch (Daisy-leaved Grape Fern)

B. minganense Vict. (Mingan Moonwort)

[*B. lunaria* f. *minganense* (Vict.) Clute (F)]

[*B. lunaria* var. *minganense* (Vict.) Dole (G,T)]

**B. mormo* Wagner ined. (Goblin Fern; fig. 2)

B. multifidum (Gmel.) Rupr. (Leather-leaved Grape Fern)

B. oneidense (Gilb.) House (Blunt-lobed Grape Fern)

[*B. dissectum* f. *oneidense* (Gilb.) Clute (F,T)]

B. simplex E. Hitchc. (Least Moonwort)



Fig. 2. The Goblin Fern, a new *Botrychium* being described by Warren H. Wagner, was recently discovered in Ashland County (by J. H. Peck in 1979). It is characterized by its reduced, fleshy appearance, deeply embedded sporangia, greatly reduced sterile segment, late appearance (July), and late spore release (October). It frequents maple-basswood forests with humus-rich soils in Michigan, Minnesota, and Wisconsin.

B. ternatum (Thunb.) Sw. (Ternate Grape Fern)

[*B. multifidum* f. *dentatum* Tryon (T)]

B. virginianum (L.) Sw. (Rattlesnake Fern)

Ophioglossum vulgatum var. *pseudopodium* (Blake) Farw. (Northern Adder's-tongue Fern)

OSMUNDACEAE

Osmunda cinnamomea L. (Cinnamon Fern)

O. claytoniana L. (Interrupted Fern)

O. regalis var. *spectabilis* (Willd.) Gray (American Royal Fern)

ADIANTACEAE

Adiantum pedatum L. (Northern Maidenhair Fern)

Cheilanthes feei Moore (Slender Lip Fern)

C. lanosa (Michx.) D. C. Eat. (Hairy Lip Fern)

[*C. vestita* Sw. (F)]

Cryptogramma stelleri (Gmel.) Prantl (Slender Cliff-brake Fern)

Pellaea atropurpurea (L.) Link (Purple Cliff-brake Fern)

P. glabella Mett. ex Kuhn (Smooth Cliff-brake Fern)

POLYPODIACEAE

Polypodium virginianum L. (Rock-cap Fern)

[*P. vulgare* var. *virginianum* A. A. Eat. (G)]

DENNSTAEDTIACEAE

**Dennstaedtia punctilobula* (Michx.) Moore

Peridium aquilinum var. *latiusculum* (Desv.) Underw. (Bracken Fern)

THELYPTERIDACEAE

Phegopteris connectilis (Michx.) Watt (Narrow Beech Fern)

[*Dryopteris phegopteris* (L.) Christens. (F,T)]

[*Thelypteris phegopteris* (L.) Slosson (G,M)]

P. hexagonoptera (Michx.) Fée (Broad Beech Fern)

[*Dryopteris hexagonoptera* (Michx.) Christens. (F,T)]

[*Thelypteris hexagonoptera* (Michx.) Weatherby (G,M)]

Thelypteris palustris var. *pubescens* (Laws.) Fern. (Marsh Fern)

[*Dryopteris thelypteris* var. *pubescens* (Laws.) Nakai (F,T)]

**T. simulata* (Davenp.) Nieuwl. (Massachusetts Fern)

[*Dryopteris simulata* Davenp. (F)]

ASPLENIACEAE

Asplenium platyneuron (L.) Oakes ex D. C. Eat. (Ebony Spleenwort)

A. trichomanes L. (Maidenhair Spleenwort)

A. viride Huds. (Green Spleenwort)

**Asplenosorus pinnatifidus* (Nutt.) Mickel (Lobed Spleenwort)

[*Asplenium pinnatifidum* Nutt. (F,G,W)]

Athyrium angustum (Willd.) Presl (Northeastern Lady Fern)

[*A. filix-femina* var. *angustum* (Willd.) Moore (M,W)]

[*A. filix-femina* var. *michauxii* (Spreng.) Farw. (F,G)]

A. pycnocarpon (Spreng.) Tidestr. (Glade Fern)

A. thelypteroides (Michx.) Desv. (Silvery Glade Fern)

Camptosorus rhizophyllus (L.) Link (Walking Fern)

Cystopteris bulbifera (L.) Link (Bulblet Fragile Fern)

C. fragilis (L.) Bernh. var. *fragilis* (Northern Fragile Fern)

C. fragilis var. *mackayi* Laws. (Mackay's Fragile Fern)

- C. protrusa* (Weath.) Blasdel (Creeping Fragile Fern)
[*C. fragilis* var. *protrusa* Weath. (F,G,T)]
- C. Xlaurentiana* (Weath.) Blasdel (*C. bulbifera* X *fragilis* var. *fragilis*)
[*C. fragilis* var. *laurentiana* Weath. (F,G,T)]
- **C. Xtennesseensis* Shaver (*C. bulbifera* X *protrusa*)
[*C. fragilis* var. *simulans* (Weath.) McGregor (F,G)]
[*C. fragilis* var. *tennesseensis* (Shaver) McGregor]
- Dryopteris clintoniana* (D. C. Eat.) Dowell (Clinton's Wood Fern)
[*D. cristata* var. *clintoniana* Underw. (F,T)]
- D. cristata* (L.) Gray (Crested Wood Fern)
- D. expansa* (Presl) Fraser-Jenkins & Jermy (Spreading Wood Fern)
[*D. spinulosa* var. *americana* (Fisch) Fern. (F,T)]
[*D. austriaca* (Jacq.) Woynar var. *austriaca* (G)]
[*D. dilatata* Gray (W)]
- **D. filix-mas* (L.) Schott (Male Fern)
- D. fragrans* var. *remotiuscula* Kom. (Fragrant Fern)
- D. goldiana* (Hook.) Gray (Goldie's Fern)
- D. intermedia* (Muhl.) Gray (Glandular Wood Fern)
[*D. spinulosa* var. *intermedia* (Muhl.) Underw. (F,T)]
[*D. austriaca* var. *intermedia* (Muhl.) Morton (G)]
- D. marginalis* (L.) Gray (Marginal Wood Fern)
- D. spinulosa* (O. F. Muell) Watt (Spinulose Wood Fern)
[*D. austriaca* var. *spinulosa* (O. F. Muell.) Fiori (G)]
- D. Xboottii* (Tuckerm.) Underw. (*D. cristata* X *intermedia*)
- **D. Xpittsfordensis* Slosson (*D. marginalis* X *spinulosa*)
- **D. Xslossonae* (Hahn) Wherry (*D. cristata* X *marginalis*)
- D. Xtriploidea* Wherry (*D. intermedia* X *spinulosa*)
[*D. spinulosa* var. *fructuosa* (Gilb.) Trud. (F,T)]
[*D. austriaca* var. *fructuosa* (Gilb.) Mort. (G)]
- D. Xuliginosa* (A. Br.) Druce (*D. cristata* X *spinulosa*)
- **D. intermedia* X *marginalis*
- Gymnocarpium dryopteris* (L.) Newm. (Oak Fern)
[*Dryopteris disjuncta* (Ledeb.) Mort. (F,T)]
- G. robertianum* (Hoffm.) Newm. (Limestone Oak Fern)
[*Dryopteris robertianum* (Hoffm.) Christens. (F,T)]
- **G. Xheterosporum* Wagner (*G. dryopteris* X *robertianum*)
- Matteuccia struthiopteris* var. *pensylvanica* (Willd.) Mort. (American Ostrich Fern)
[*Pteritis pensylvanica* (Willd.) Fern. (F)]
[*Matteuccia pensylvanica* (Willd.) Raym. (W)]
- Onoclea sensibilis* L. (Sensitive Fern)
- Polystichum acrostichoides* (Michx.) Schott (Christmas Fern)
- P. braunii* (Spenner) Fée (Braun's Holly Fern)
- Woodsia ilvensis* (L.) R. Br. (Rusty Cliff Fern)
- W. obtusa* (Spreng.) Torr. (Blunt-lobed Cliff Fern)
- W. oregana* D. C. Eat. (Western Cliff Fern)
[*W. cathcartiana* Robins. (F,T,W)]
[*W. oregana* var. *cathcartiana* (Robins.) Mort. (G)]
- **W. Xabbeae* Butters (*W. ilvensis* X *oregana*)

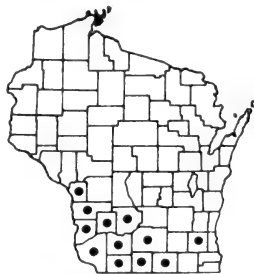
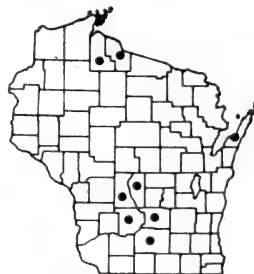
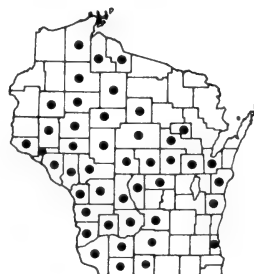
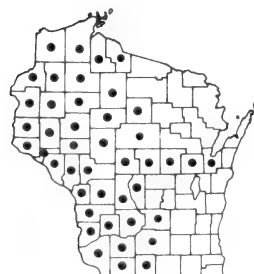
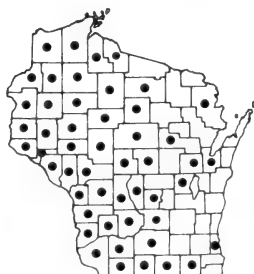
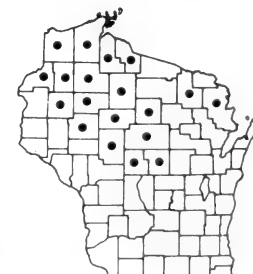
AZOLLACEAE

- Azolla mexicana* Presl (Mosquito Fern)
[*A. caroliniana* Willd.) (F)]

LITERATURE CITED

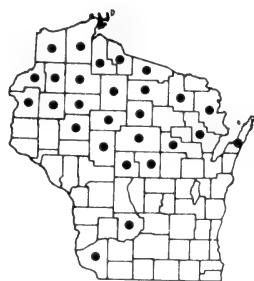
- Beitel, J. M. 1979. Clubmosses (*Lycopodium*) in North America. *Fiddlehead Forum* 6(5): 1-8.
- Buck, W. R. 1977. A new species of *Selaginella* in the *S. apoda* complex. *Can. J. Bot.* 55: 366-371.
- Blasdel, R. 1963. A monographic study of the fern genus *Cystopteris*. *Mem. Torrey Bot. Club* 21(4):1-102.
- Brown, D. F. M. 1964. A monographic study of the fern genus *Woodsia*. *Nova Hedwigia Beih.* 16:1-154.
- Carlson, T. J. 1979. The comparative ecology and frequencies of interspecific hybridization of Michigan woodferns. *Mich. Bot.* 18:47-56.
- Crabbe, J. A., A. C. Jermy & J. T. Mickel. 1975. A new generic sequence for the pteridophyte herbarium. *Fern Gaz.* 11:141-162.
- Fernald, M. L. 1922. *Polypodium virginianum* and *P. vulgare*. *Rhodora* 24:125-142.
- . 1928. The eastern American variety of *Polystichum braunii*. *Ibid.* 30: 28-30.
- . 1950. *Gray's Manual of Botany*. 8th ed. American Book Co., New York.
- Fraser-Jenkins, C. R., & A. C. Jermy. 1977. Nomenclatural notes on *Dryopteris*. *Fern Gaz.* 25:378-379.
- Gleason, H. A., & A. Cronquist. 1963. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. Van Nostrand Co., New York.
- Hauke, R. L. 1963. A taxonomic monograph of the genus *Equisetum*, subgenus *Hippochaete*. *Nova Hedwigia Beih.* 8:1-163.
- . 1965. Preliminary reports on the flora of Wisconsin no. 54. *Equisetaceae*. *Trans. Wis. Acad.* 54:331-346.
- . 1966. A systematic study of *Equisetum arvense*. *Nova Hedwigia* 13: 81-109.
- . 1974. The taxonomy of *Equisetum*—an overview. *New Botanist* 1:89-95.
- . 1978. A taxonomic monograph of *Equisetum* subgenus *Equisetum*. *Nova Hedwigia* 30:385-455.
- Hickey, R. J. 1977. The *Lycopodium obscurum* complex in North America. *Amer. Fern J.* 67:45-48.
- & J. M. Beitel. 1979. A name change for *Lycopodium flabelliforme*. *Rhodora* 81:137-140.
- Liew, F. S. 1972. Numerical taxonomic studies on North American lady ferns and their allies. *Taiwania* 17:190-216.
- Lloyd, R. M. 1971. Systematics of the onocleoid ferns. *Univ. Cal. Pub. Bot.* 61:1-86.
- Løve, A. 1962. Cytotaxonomy of the *Isoetes echinospora* complex. *Amer. Fern J.* 52: 113-123.
- Mickel, J. T. 1974. The status and composition of *Asplenosorus*. *Amer. Fern J.* 64:119.
- . 1979. *How to Know the Ferns and Fern Allies*. W. C. Brown, Dubuque.
- Mulligan, G. A., L. Cinq-Mars & W. J. Cody. 1972. Natural interspecific hybridization between sexual and apogamous species of the beech fern *Phegopteris Fée*. *Can. J. Bot.* 50:1295-1300.
- Pfeiffer, N. 1922. Monograph of the *Isoetaceae*. *Ann. Missouri Bot. Gard.* 9:79-232.
- Sarvela, J. 1979. A synopsis of the fern genus *Gymnocarpium*. *Ann. Bot. Fenn.* 15: 101-106.
- Svenson, H. K. 1944. The New World species of *Azolla*. *Amer. Fern J.* 34:69-84.
- Tryon, A. F. 1957. A revision of the genus *Pellaea* section *Pellaea*. *Ann. Missouri Bot. Gard.* 44:125-193.
- Tryon, A. F., & R. M. Tryon. 1973. *Thelypteris* in northeastern North America. *Amer. Fern J.* 63:65-76.
- Tryon, R. M. 1941. Revision of the genus *Pteridium*. *Contr. Gray Herb.* 134:1-70.
- . 1955. *Selaginella rupestris* and its allies. *Ann. Missouri Bot. Gard.* 42:1-99.
- . 1960. A review of the genus *Dennstaedtia* in America. *Contr. Gray Herb.* 187:23-52.

- Tryon, R. M., N. C. Fassett, D. W. Dunlop & M. E. Diemer. 1953. The Ferns and Fern Allies of Wisconsin. Univ. Wis. Press, Madison.
- Wagner, W. H., Jr. 1954. Reticulate evolution in the Appalachian Aspleniums. *Evolution* 8:103-118.
- _____. 1959. American grapeferns resembling *Botrychium ternatum*: a preliminary report. *Amer. Fern J.* 49:97-103.
- _____. 1960. Evergreen grapeferns and the meanings of interspecific categories used in North American pteridophytes. *Ibid.* 50:21-45.
- _____. 1966. New data on North American oak ferns, *Gymnocarpium*. *Rhodora* 68:121-138.
- _____. 1971. Evolution of *Dryopteris* in relation to the Appalachians. pp. 147-192 in P. C. Holt, The distributional history of the biota of the southern Appalachians. Part II. *Flora. Res. Monog. II*, Virginia Polytechnic Inst., Blacksburg.
- _____. & L. P. Lord. 1956. The morphological and cytological distinctness of *Botrychium minganense* and *B. lunaria* in Michigan. *Bull. Torrey Bot. Club* 83:261-280.
- Wherry, E. T. 1961. The Fern Guide. Doubleday, New York. Reprinted 1975, Morris Arboretum, Philadelphia.
- Wilce, J. H. 1965. The section *Complanata* of genus *Lycopodium*. *Nova Hedwigia Beih.* 19:1-233.

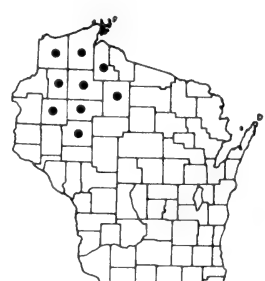
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13. *Botrychium lunaria*



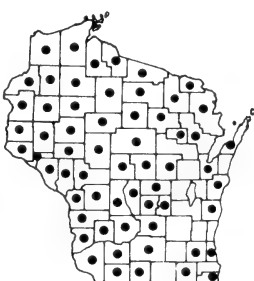
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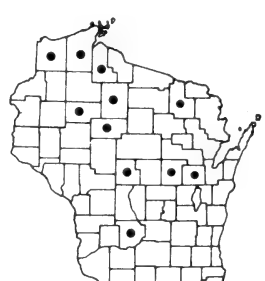
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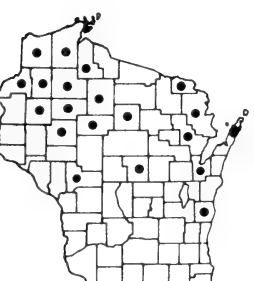
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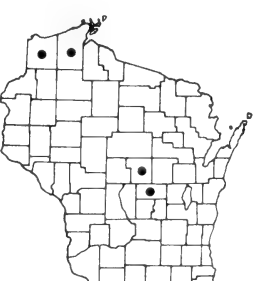
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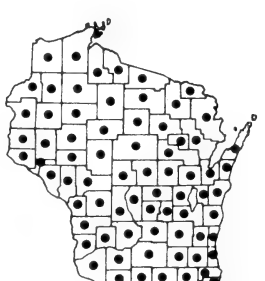
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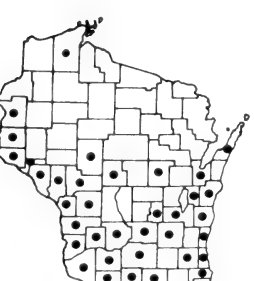
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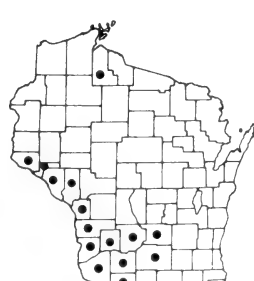
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21. *Botrychium virginianum*



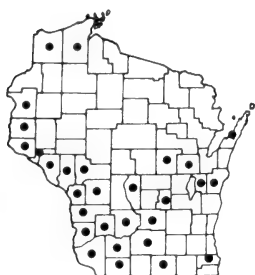
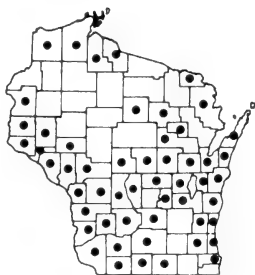
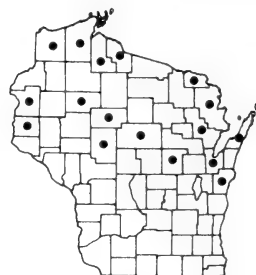
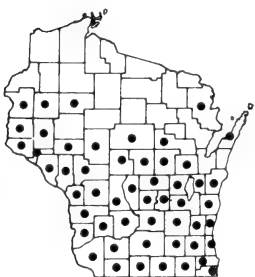
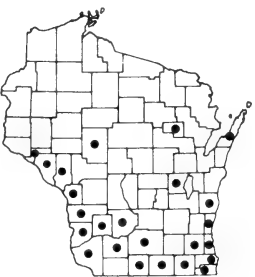
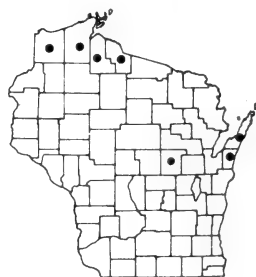
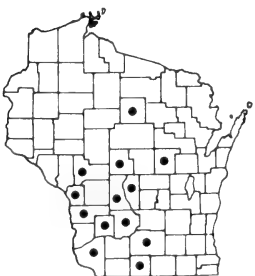
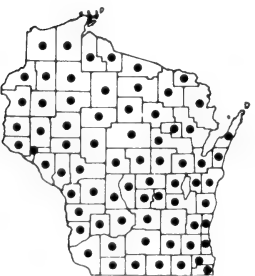
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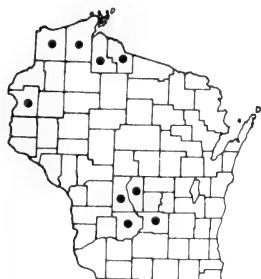
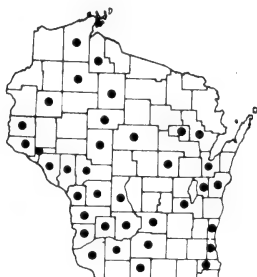
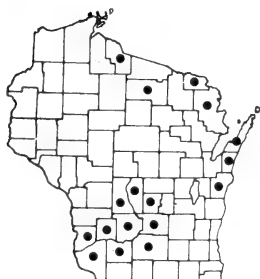
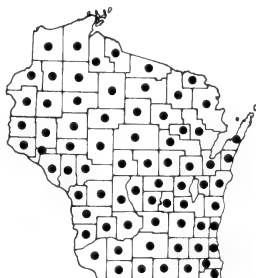
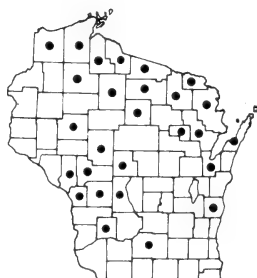
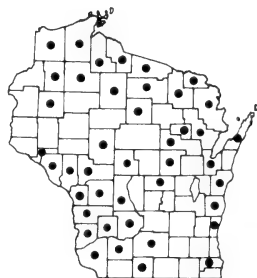
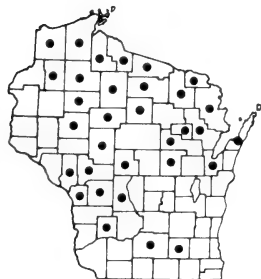
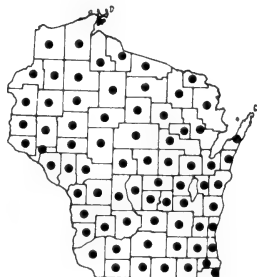


23. *Cheilanthes feei*



24. *Cheilanthes lanosa*

25. *Cryptogramma stelleri*26. *Cystopteris bulbifera*27. *Cystopteris fragilis* var. *fragilis*28. *Cystopteris fragilis* var. *mackayi*29. *Cystopteris protrusa*30. *Cystopteris* X *laurentiana*31. *Cystopteris* X *tennesseensis*32. *Dennstaedtia punctilobula*33. *Dryopteris clintoniana*34. *Dryopteris cristata*35. *Dryopteris expansa*36. *Dryopteris filix-mas*

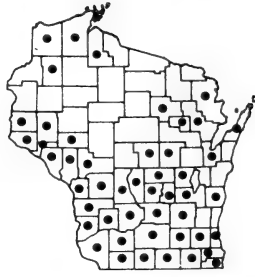
37. *Dryopteris fragrans*38. *Dryopteris goldiana*39. *Dryopteris intermedia*40. *Dryopteris marginalis*41. *Dryopteris spinulosa*42. *Dryopteris Xboottii*43. *Dryopteris Xpittsfordensis*44. *Dryopteris Xslossonae*45. *Dryopteris Xtriploidea*46. *Dryopteris Xuliginosa*47. *D. intermedia X marginalis*48. *Equisetum arvense*



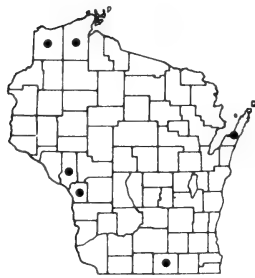
49. *Equisetum fluviatile*



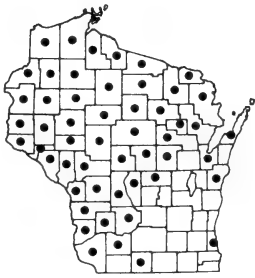
50. *Equisetum hyemale*



51. *Equisetum laevigatum*



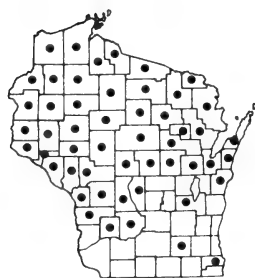
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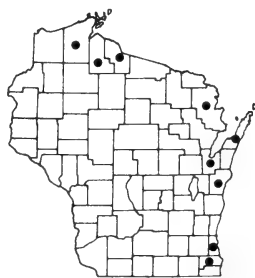
53. *Equisetum pratense*



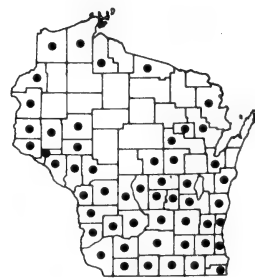
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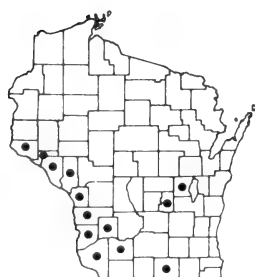
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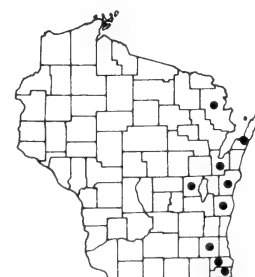
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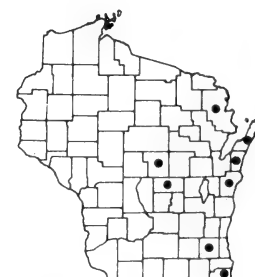
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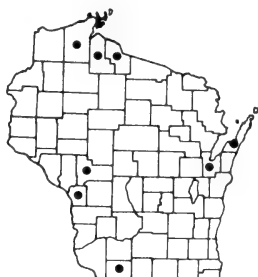
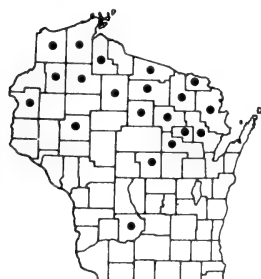
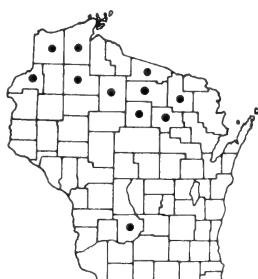
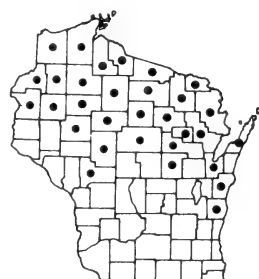
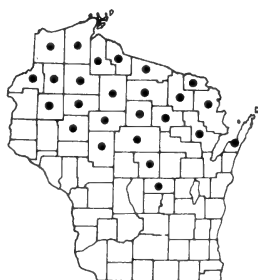
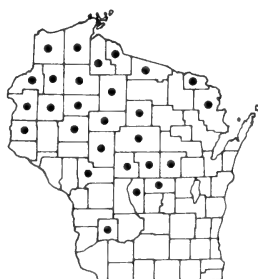
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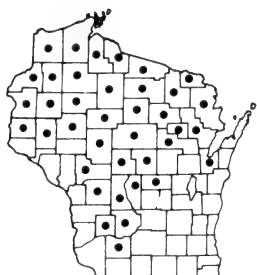
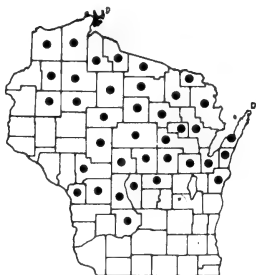
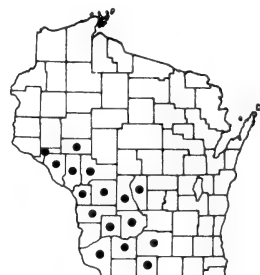
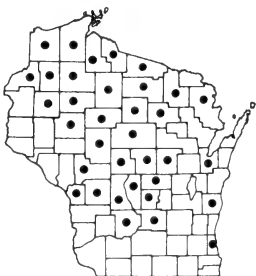
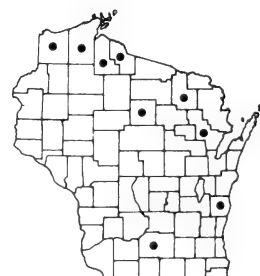
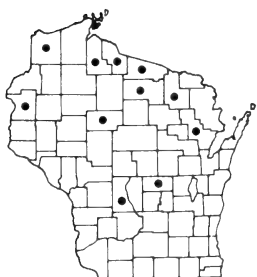
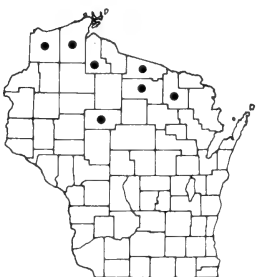
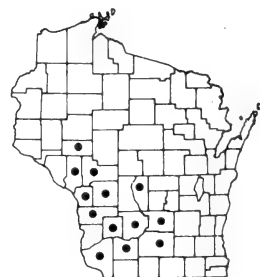
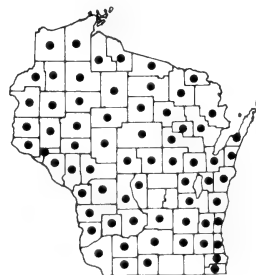
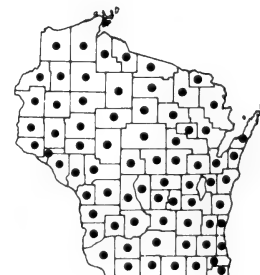
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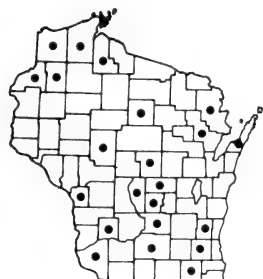
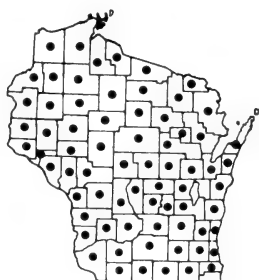
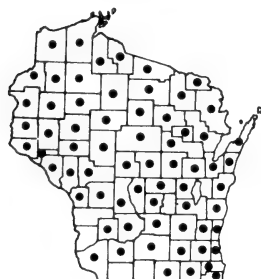
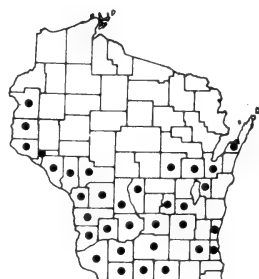
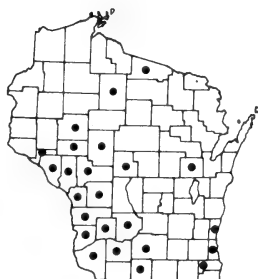
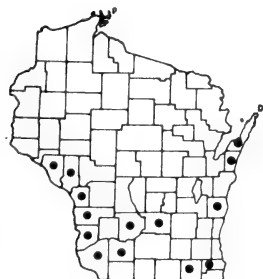


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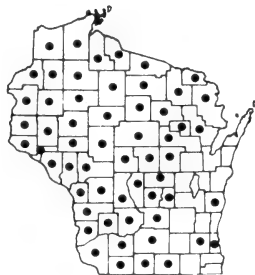
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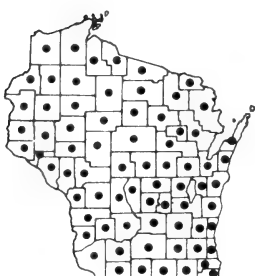
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98. *Selaginella rupestris*



99. *Selaginella selaginoides*



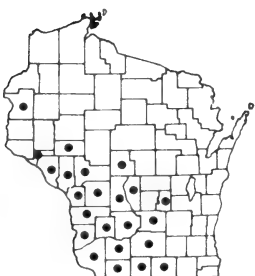
100. *Thelypteris palustris*



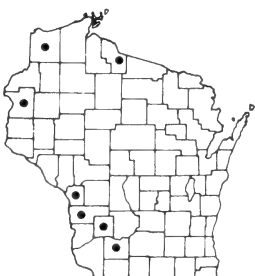
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**STUDIES ON *POPULUS HETEROPHYLLA*
IN SOUTHERN MICHIGAN**

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The current enthusiasm for locating rare, threatened, and endangered species in the United States has led to the accumulation of significant biological information on many species. In Michigan, an attempt to identify such plants (Wagner et al., 1977) was followed by an unpublished listing of those species with brief descriptions of morphology, ecology, distribution, and limiting factors (Good, 1978). There is a continuing need for studying such species in order to monitor their proliferation or demise. Such studies may be quite simple in method, yet rewarding in information. It is hoped that this example will stimulate similar investigations.

Populus heterophylla L., commonly known as the swamp cottonwood (also as black cottonwood, river cottonwood, downy poplar, black poplar, and swamp poplar), is so scarce in Michigan it is not listed in *Michigan Trees* (Otis, 1931), nor is it included in the forthcoming revision, *Otis' Michigan Trees* (Barnes & Wagner, in press). *Populus heterophylla* occurs sporadically to frequently in areas of the eastern and central United States and southern Michigan where it reaches its northern limit. The present study of the known populations of *P. heterophylla* in Michigan was undertaken in order to build a detailed data base for the continued monitoring of this species.

The swamp cottonwood is a medium-sized tree, less than a meter in diameter, usually 10 to 20 meters tall, but occasionally reaching 30 meters (Fernald, 1950), with short, heavy, contorted branches forming a somewhat round-topped crown (Fig. 1a). The bark of mature trees (Fig. 1b) is rather deeply fissured and is light-brown tinged with red, showing a strong resemblance to the bark of sassafras (*Sassafras albidum*). The pith of young twigs (Fig. 1c) has a distinctive orange color. The vegetative buds are reddish-brown, shiny, and somewhat resinous. The leaves have a terete petiole and a broadly ovate to cordate lamina 8 to 25 cm long and 6 to 20 cm wide, with coarsely rounded, glandular, marginal teeth. The laminar surfaces are dark, lustrous green above and pale-green to green-yellow below. The unisexual flowers appear in the spring

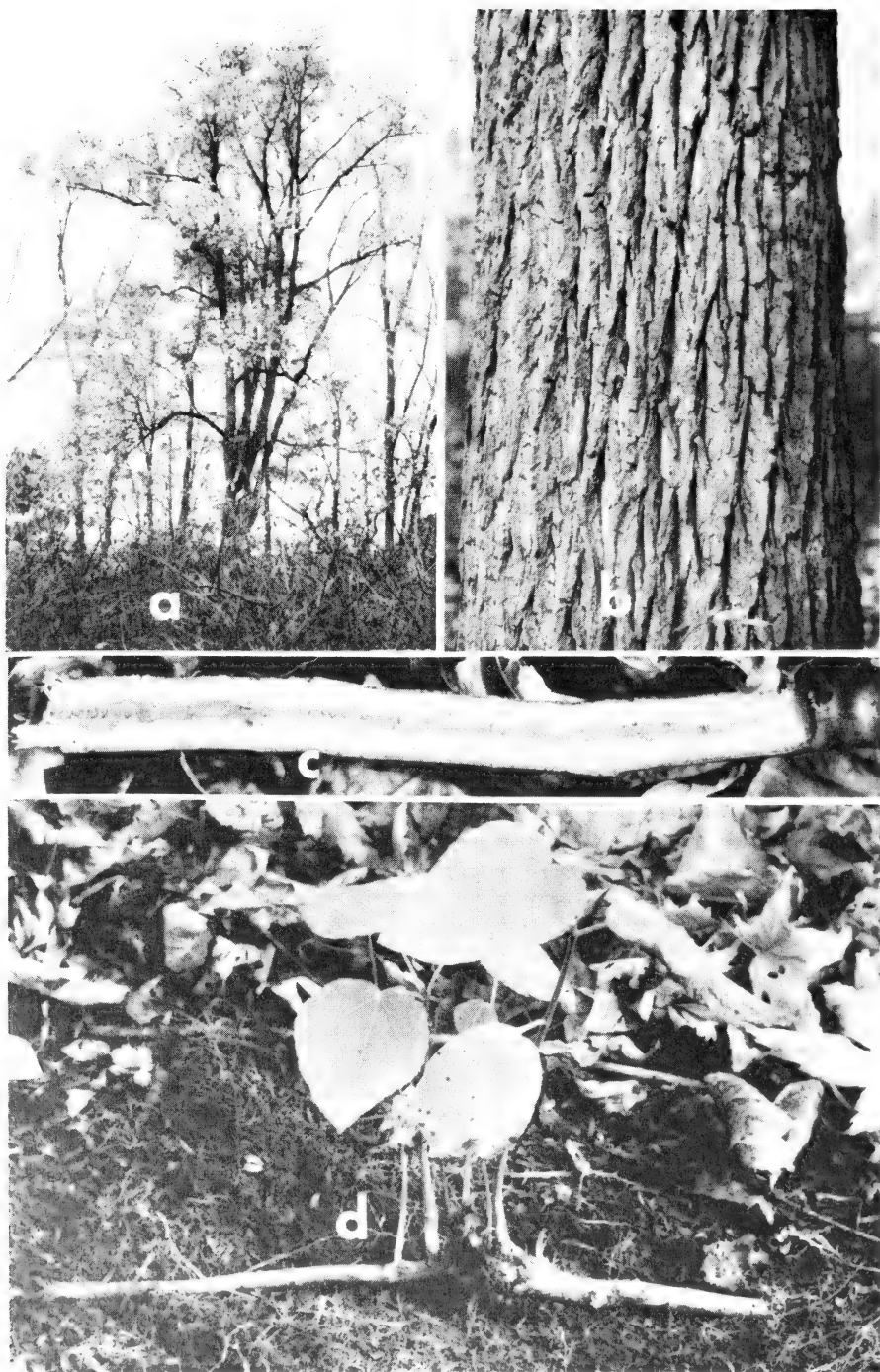


Figure 1. *Populus heterophylla*. Washtenaw Co. locality. a. Habit of tree and habitat, showing an abundance of *Cephalanthus* in the foreground. b. Surface of bark. c. Longitudinal section of twig showing distinctive dark pith. d. Root-sucker.

on separate trees in catkins less than 10 cm long. The capsular fruits ripen in the summer and release large quantities of cottony seeds.

In many features, the leaves resemble those of *P. deltoides*, the common cottonwood (Fig. 2). The leaves of *P. heterophylla* (Fig. 3) may be distinguished, however, by terete petioles, acute apices, and sparse laminar pubescence (when mature). The leaves of *P. deltoides* have flat petioles, apiculate apices, and glabrous laminar surfaces.

The species has a very patchy distribution from Connecticut southward along the Atlantic coastal plain to Georgia, westward along the Gulf coastal plain from Florida to Louisiana, and northward in the Mississippi and Ohio River drainage systems to southern Michigan (Little, 1971). The only extensive, continuous areas in which the species occurs are the coastal plain of the Carolinas and along the Mississippi and Ohio Rivers in eastern Missouri, southern Illinois, and Indiana. The species prefers swamps and other wet places, in bottomlands and floodplains or at the edges of ponds.

Populus heterophylla has been collected in four counties in southern Michigan: Berrien, Cass, Kalamazoo, and Washtenaw. Apparently the species was first found in Michigan by H. J. Ray in 1882. The fruiting specimen (s.n., MSC) was taken from an unrecorded locality in Cass County. In his flora of Michigan (1904), Beal's report from Cass County was based on Ray's collection (as J. H. Roy). It is not known to us whether *P. heterophylla* still survives in that county. The species was subsequently collected in 1917 by C. K. Dodge (no. 353, MICH) at Paw Paw Lake in Berrien County. Dodge's notes, including those on the flora of Berrien County, deposited at the University of Michigan Herbarium, reveal that the species was collected on the north banks of Paw Paw Lake, where there were numerous large individuals. Many of the accessible portions of the lake were surveyed for *P. heterophylla* during our study, but no plants were located. Some low areas apparently offer a suitable habitat for the plant and include many species often associated with it. In addition, the shores of Paw Paw Lake include many other predominantly southern trees uncommon in Michigan (*Cercis canadensis*, *Platanus occidentalis*, *Liriodendron tulipifera*, *Asimina triloba*, *Acer saccharinum*, and *Morus rubra*). It is not unlikely that the plant will be found again in this region, although the extensive development of houses around the lake has undoubtedly been a restricting factor in the perpetuation of the species.

Populus heterophylla has been collected several times in Washtenaw County, all the collections probably coming from the same locality (3 mi. SW of Ann Arbor, Clark s.n., 28 Oct. 1919; 2 mi. SW of Ann Arbor, Ehlers 1871, Erlanson s.n., 15 Oct. 1921; Liska's Farm, N of Waters Road, Lodi Township, sec. 12, Wagner 9402—all at MICH). At this locality, trees are found in four different places in an area of approximately 400 square meters. The surrounding woods have been damaged by various factors, but the species composition indicates a formerly rich, beech-sugar maple community. Species in the uplands include *Acer nigrum*, *A. saccharinum*, *Asimina triloba*, *Carpinus caroliniana*, *Carya cordiformis*, *C. glabra*, *C. ovata*, *Celastrus scandens*, *Fagus grandifolia*, *Juglans cinerea*, *J. nigra*, *Lindera benzoin*, *Ostrya virginiana*, *Populus deltoides*, *P. tremuloides*, *Prunus serotina*, *Rhamnus cathartica*, *Rubus allegheniensis*,

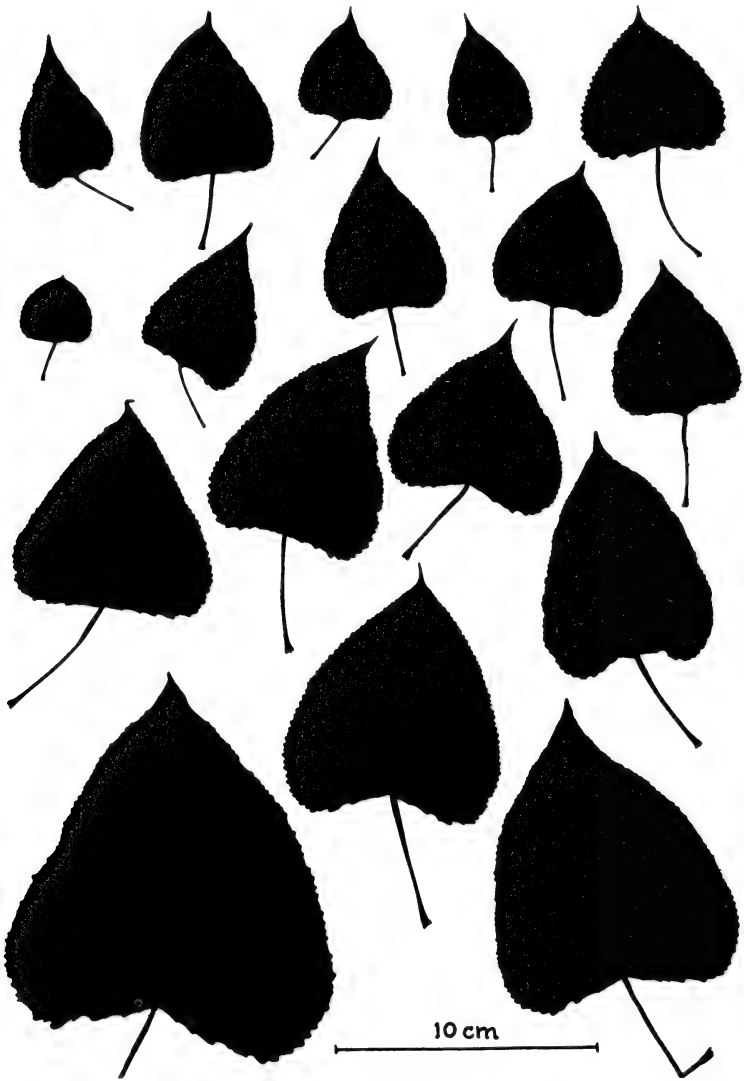


Figure 2. Variation in leaves of *Populus deltoides*.

Salix nigra, *Staphylea trifolia*, *Tilia americana*, *Ulmus americana*, and *Vitis riparia*. As this list of woody plants shows, in spite of disturbance, native plants predominate; only *Rhamnus cathartica* is introduced.

All of the swamp cottonwoods in the Washtenaw County locality grow at the edges of low, open areas which flood during at least part of the year (Fig.

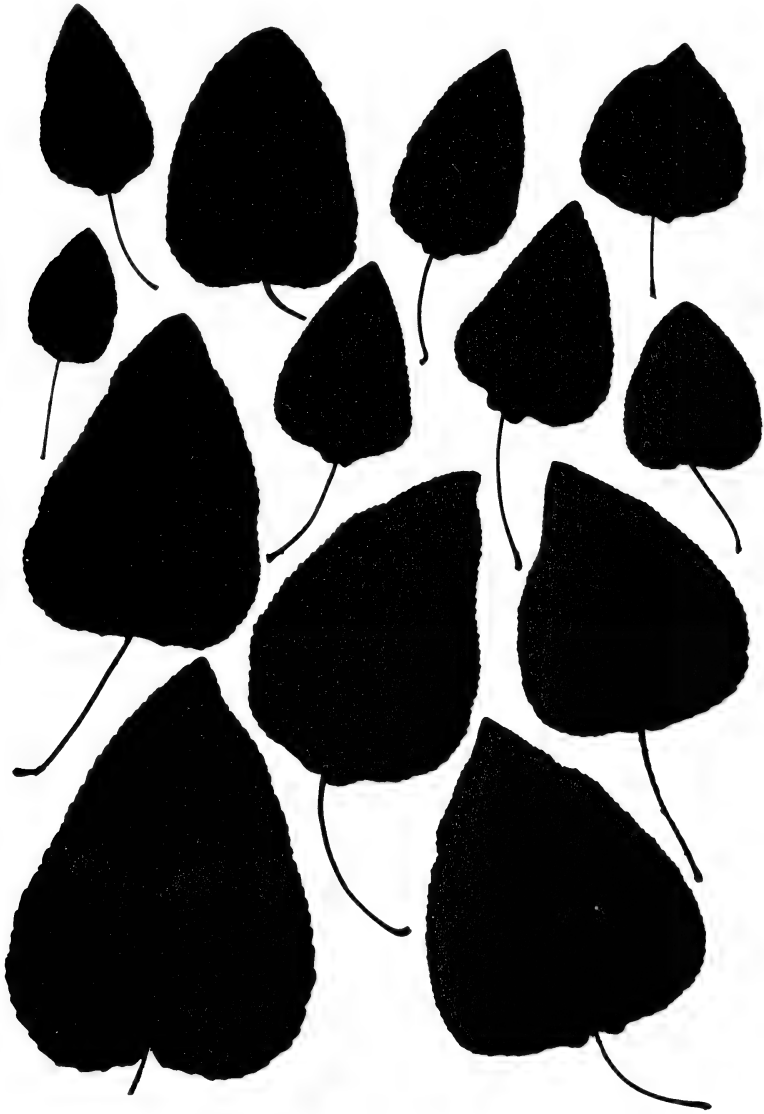


Figure 3. Variation in leaves of *P. heterophylla* (at same scale as fig. 2).

1a). These swampy depressions range from about 10 to 40 meters in diameter. There is a tendency for the trees to be clustered at their northern and western edges where they grow in up to 80 centimeters of water during the spring. The number of plants above four meters in height at the four sites varies from one to approximately 30. The dominant species in the depressions is *Cephalanthus*

occidentalis, with *Acer saccharinum*, *A. rubrum*, *Ilex verticillata*, and *Quercus bicolor* occurring sporadically. Other, less common woody species include *Cornus racemosa*, *Fraxinus pennsylvanica*, and *Tilia americana*. Conspicuous herbs observed in September at the different sites include *Bidens* sp., *Pilea pumila*, *Polygonum pensylvanicum*, *Scutellaria lateriflora*, and *Xanthium strumarium*.

Reproduction in this population occurs by both sexual and asexual means. At one of the four sites, we observed masses of cottony seeds among the shrubs below many of the larger trees in the fall of 1979. The sex of the individual trees was determined during May of 1980. The two sites where seeds were observed in the fall consisted of both male and female clones, including large (taller than 10 meters) and small (shorter than 10 meters) trees of each sex. The other sites, each consisting of a single large tree and numerous root-suckers, were found to contain only male plants. A small number of seedlings are present at the sites with both male and female clones. Most conspicuous at each of the sites, however, are numerous root-suckers (Fig. 1d) in the muddy substratum near the larger trees where proliferous roots run along the ground just below the soil surface. The large number of root-suckers, contrasted with the small number of seedlings, suggests that *P. heterophylla* is largely clonal at each of the four sites. However, sexual reproduction appears to be important in the colonization of new sites as the individual stands are separated by 20 to 150 meters of forest. The surrounding woods offers several depressions into which *P. heterophylla* might be expected to expand.

Clarence and Florence Hanes collected *P. heterophylla* in a "cathole" northwest of Kimble Lake (Kalamazoo Co.) in 1937 (no. 3137, MICH, WMU) and again in 1940 (no. 2230, WMU). In their flora of Kalamazoo County (1947), the population was described as consisting of a few trees, the largest of which was two feet in diameter at the base. This single, apparently clonal stand of young and old trees was visited on 19 October 1979. It is much less open than the sites in Washtenaw County, and the adjacent woods have only recently been disturbed by building operations. The area in which the trees occur is approximately 22 by 16 meters. In this wet depression, throughout which *P. heterophylla* is scattered, the dominant associates, with the exception of *Acer saccharinum*, are the same as those at the Washtenaw County sites (*Acer rubrum*, *Ilex verticillata*, *Quercus bicolor*, and *Cephalanthus occidentalis*). Other woody plants include *Rubus allegheniensis*, *Vaccinium corymbosum*, *Vitis riparia*, and *Fraxinus pennsylvanica*. Among the many herbaceous plants are *Dryopteris spinulosa*, *Lycopus* sp., *Carex crinita*, *Echinochloa crusgalli*, *Pilea pumila*, and *Dioscorea villosa*. The surrounding woods are not as rich as those at the Washtenaw County locality and are composed primarily of oak-hickory associates. Three other species of *Populus* (*P. deltoides*, *P. grandidentata*, and *P. tremuloides*) are common there.

The colony comprises 25 individuals four meters or more in height and numerous smaller root-suckers. The tallest individual, the Michigan champion thus far, has a circumference at breast height of 1.72 meters (= 0.55 meters in diameter) and a height of nearly 20 meters. The crown extends 17.6 meters at its widest diameter.

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None of the cottony seeds were found on the shrubs in the vicinity of the larger trees, suggesting that the entire colony in this "cathole" consists of male individuals and that reproduction is entirely by root-suckering. Indeed, when this population was revisited in the spring of 1980, only male catkins were found under the trees.

The Haneses noted that the swamp cottonwood had scale infestation at this site. Although we did not observe this, we did notice numerous small leaf galls of the type produced by aphids or eriophyid mites.

Both populations of *P. heterophylla* visited during this study were well-established and reproducing. The individual stands of the species appeared to be largely clonal, but limited sexual reproduction was observed at one site. Despite the presence of other species of *Populus* at both locations, no evidence of hybridization between species was encountered.

The future of these populations is uncertain. Plans for the development of the Liska Farm in Washtenaw County are not yet established, but it is possible that it will be divided and developed because of the demand for housing and the expansion of Ann Arbor's suburbs. Future plans for the property containing the "cathole" with *P. heterophylla* in Kalamazoo County were not revealed to us. Houses are being built in the immediate region, and some of the owners have cleared large areas for lawns and gardens. Thus both localities are potentially vulnerable to urban development. For this reason, and because only two of the four reported localities in the state are presently known, *P. heterophylla* should be maintained at the status of a threatened species (that is, threatened with extirpation in Michigan and likely to become endangered in the foreseeable future throughout all or a significant portion of its range in this state). Every effort should be made to convince owners of the areas around the swamp cottonwood colonies to preserve them. The Washtenaw and Kalamazoo County localities can probably be maintained if they are left in their relatively pristine condition, including the wet areas, their wooded margins, and a protective border of buffer forest.

The authors thank the owners of properties visited during this study for permission to collect data, Harvey Ballard of Kalamazoo College for leading us to the Kalamazoo County locality and aiding in its study, and Dr. E. G. Voss, who provided access to C. K. Dodge's notebooks.

REFERENCES

- Beal, W. J. 1905. Michigan Flora. Rep. Mich. Acad. 5: 1-147. ("1904").
Fernald, M. L. 1950. Gray's Manual of Botany. 8th ed. Van Nostrand Reinhold Co., New York. lxiv + 1632 pp.
Good, D. 1978. Threatened, Endangered, and Extinct Species of Michigan Plants. Manuscript. Michigan Endangered and Threatened Species Program.
Hanes, C. R. & F. N. Hanes. 1947. Flora of Kalamazoo County, Michigan. Vascular Plants. Schoolcraft, Mich. xii + 295 pp.
Little, E. L., Jr. 1971. Atlas of United States Trees. Vol. I. Conifers and Important Hardwoods. USDA Misc. Publ. 1146, v + 9 + 200 maps + index.
Otis, C. H. 1931. Michigan Trees. University of Michigan Press, Ann Arbor. 362 pp.
Wagner, W. H., Jr., et al. 1977. Endangered, threatened, and rare vascular plants in Michigan. Mich. Bot. 16: 99-110.

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*On the cover: Rosin Weed (Silphium integrifolium),
a prairie species threatened in Michigan
(photographed by Richard Pippen, July
1978, in Kalamazoo County)*

